

Hedge Planting and Restoration

Hedges provide highly valued landscape and conservation benefits whilst also having a high practical value as fences and shelter for stock. They can also provide less obvious benefits, for example as a refuge for pollinating insects.

Currently millions of trees and shrubs are planted every year as part of various environmental initiatives, unfortunately often with limited success. A recent report by the Countryside Commission suggests that there is 'a serious lack of knowledge about tree planting' resulting in a massive failure rate in new schemes. Key problems identified were, inadequate ground preparation, poor plant handling and most crucially a lack of effective weed control post planting. This document and the companion Technical Guidance Card have been prepared in an attempt to address the knowledge gap.

Hedgerow Establishment Issues

1. The Choice of plant stock and species

A) Soils and Species Choice

Hedges in County Durham are predominantly composed of thorny species, principally hawthorn with blackthorn and holly occasionally serving as significant, or more rarely dominant constituents.

These species were preferred for their hardiness and ability to contain stock. Recommended planting mixtures are available from Durham County Council. Depending on the location, 60% hawthorn and 20-25% blackthorn is recommended together with small proportions of other native species such as hazel, holly, guelder, rose and crab apple in order to enhance the wildlife value of the hedge. In small numbers, intermixed with the thorn's, these species will not detract from a hedge's ability to contain stock. All recommended species may be managed by laying or trimming. The species suggested will thrive in most natural soils, specialist advice may be required when planting in atypical situations for example on reclaimed land.

Hedgerow trees are an important though declining feature of the landscape, they can add greatly to the wildlife value of a hedge whilst providing a useful source of shelter for stock. Planting trees into new hedges is strongly recommended, ash and oak are the suggested species. Trees should be planted no closer together than 20m (65'), irregularly spaced to conform with traditional landscape patterns. Holly, due to its ability to tolerate shade, is recommended for hedge planting adjacent to hedgerow trees.

B) Provenance

The origin or provenance of plant material is a topic currently generating considerable debate in the environmental field. Concern has been expressed that the widespread use of plants grown from foreign seed is eroding the genetic integrity of our native species. This is a complex area of debate and it is not intended to address the arguments in this document in any detail. Durham County Council recommends the use of plants derived from native (seeds derived from British plant stock) preferably local seed sources. Such plants are adapted to local conditions and therefore more likely to establish themselves successfully.

C) Planting Stock

The most commonly available used form of plant material is bare root stock. These are plants supplied (**Illustration 1**) with the minimum of soil remaining attached to the root system. Bare root plants may be sold as transplants, undercut or side air pruned stock. The terms used refer to the different methods employed by nurseries to produce a compact root system. This is beneficial because it leads to reduced damage during lifting from the nursery and is an aid to successful establishment.



1. An example of a good quality bare root plant

The most common form of plant material for large scale planting schemes is two year old stock in the size ranges 25-40cm and 40-60cm. Plants of this size and age have been found to be the most successful during the establishment phase. In nursery literature, stock of this size may be described as 1+1, referring to the practice of growing the plant on for one year before transplanting to a new situation where it is grown on for a further year. Or 1u1, meaning that the stock has been grown on in the same position but has had the root system undercut after one years growth.

A recent development in nursery practice is side air pruning. Plants are grown in the field but are claimed to develop a more compact fibrous root system due to the practice of maintaining open air channels between the rows of seedlings.

Some species e.g. holly are not usually available as bare root stock but as container grown or cell grown (see below) plants. Avoid containerised plants which may only recently have been potted up.

The only significant alternative to bare root stock are cell grown plants. (**Illustration 2**). These are grown from seed in small individual containers, resulting in a compact root plug. Cell grown plants are significantly more expensive than the alternatives but do offer proven benefits which can make the initial extra expenditure worthwhile in certain circumstances.



2. A cell grown plant. The compact root plug enables faster planting.

Benefits of Cell grown plants

- Quicker and easier to plant. This is a particular advantage in stoney ground, for example on top of old hedge cams.

- Plants are available and can be planted outside of the main planting season (Sept-May) allowing greater flexibility. Field grown plants are often not available until mid-November.

Disadvantages of Cell Grown Stock

- Expense.

- They are not recommended for clayey soils as the roots of the young plants, grown in a peat medium, frequently have difficulty in penetrating the surrounding soil.

2. Ground Preparation

"The land should be as carefully prepared for hedges as for any productive field crop" A. Vernon 1899.

The nature and condition of the soil and the form of vegetation control to be adopted are the

principal considerations when determining an appropriate approach to ground preparation.

Cultivation

Cultivation by ploughing and/or rotovation offers a number of benefits and may be a pre-requisite on some soils. On light free draining soils it is usually not strictly necessary but is often worthwhile as it can greatly speed up planting operations.

Cultivate a strip at least 250mm (10") deep by 300mm (12") wide, just prior to planting. On **heavy clay soils** it is best to start roughly preparing the ground in the winter before planting, allowing the weather to break the soil down to form a more amenable planting medium.

Where the soil is known to have a deep pan (an impermeable layer in the soil) or to suffer from compaction e.g. on old reclamation sites, it may be necessary to **sub-soil** the hedge line in order to avoid problems with drainage or poor rooting which can lead to plant instability. This can be followed by ploughing and/or rotovation.



3. New hedge planting on a cam at Chappans Well Local Nature Reserve, a former opencast site. (Photo Sue Mullinger)

Alternatively a **hedge 'cam'** can be thrown up. This is most simply achieved by turning two plough lines against each other to form a raised planting bed.

Alternatively top soil can be imported onto site or excavated from along the edge of the proposed hedgeline (**Illustration 3**). Cams should finish about 350-450mm (14-18") high and may be upto 900mm wide (3ft). Planting should only be undertaken when the ground has settled.

Hedgebanks are a more substantial feature usually constructed with imported soils or using material excavated adjacent to the hedgeline during ditch digging operations. It is important that the bank be finished with the best quality soil available. In some parts of the County, banks may occasionally be seen which have been built with a low drystone wall on one or both sides to retain the soil core. .

Planting on cams or banks keeps the 'feet' of the plants dry whilst also providing greater potential rooting depth. It is a useful option wherever drainage is likely to be a problem or the soils are very thin and is a technique frequently used on restored land.

Banks and cams can provide significant wildlife benefits, as the raised material provides bare ground and well drained soils providing nesting and overwintering sites for many species of animal. These include agriculturally useful species





4. *Andrena clerkella* a solitary bee species requiring bare ground.
© R. S. Key

such as ground beetles, many of which are predators of agricultural pests and solitary bee species some of which are important crop pollinators (Illustration 4).

Vegetation control (pre-planting)

Vegetation control is an essential pre- (and post) planting operation. Many weed species, particularly grasses, are extremely competitive with new plants for light, nutrients and water. Existing vegetation should be suppressed. The method by which this is achieved should take into account future weed control operations. (See section on aftercare)

In addition to the other benefits it offers, cultivation is effective in initially suppressing any existing vegetation on a site. However the ground will rapidly be recolonised and it is essential that an effective method of long term weed control is adopted post planting. Cultivation of a wide strip, at least 80cm (32"), works well in conjunction with the use of a sheet mulch (see section on aftercare) as it makes planting and the positioning of the mulch far easier.

Spraying off weed growth with an appropriate herbicide in the August / September prior to planting is beneficial whatever form of long term weed control is planned. Organic mulches in particular are much more effective where weed growth has been sprayed off prior to their application.

Screening is a manual method of ground preparation best suited to small projects or when planting into existing hedges. It involves using a spade to "shave" the ground of vegetation. Whilst useful for initially clearing live vegetation from an area it leaves the weeds root systems largely intact and is therefore only useful as a means of controlling weed competition in the short term. It can be useful as a means of facilitating planting prior to the use of a sheet mulch or a herbicide control regime.

3. When to Plant

A) The Planting Season

Planting of bare root stock can be undertaken from the end of October to the end of March/early April. During this season the water and nutritional requirements of broad leaved plants are low making them less vulnerable to the stresses of transplantation. Cell grown plants can theoretically be planted all year round but best results are likely when planted between September - May. They may require attention in the form of watering if planted late in a dry spring.

Wherever possible planting should be undertaken early in the season. This allows the plants more time to establish a network of feeder roots before the demands of spring are upon them. However in areas with heavy clayey soils it may be advisable to leave planting until the beginning of March, as heavy frosts can cause 'frost heave' where plants are lifted by the expansion of water in the soil. This can lead to the roots of the plants being exposed.

B) Weather Restrictions and Storage Issues

Planting should not be undertaken during periods of hard frost and snow. Where possible windy or sunny days should be avoided to reduce the possibility of root desiccation. Bagged plants arriving during a period of inclement weather can be stored for short periods of up to ten days. They should be kept upright in a well ventilated, unheated building with the end tied up to prevent moisture loss. Where the period of storage exceeds a few days it is advisable to add water to the roots.



5. Heeled in plants

If it is planned to store the plants for long periods of time they should be heeled in. This involves digging a shallow trench, spacing the trees tightly along the edge of the trench, then throwing the earth back into the trench and loosely treading it in (Illustration 5).

Plants stored in this way can be kept for several weeks or even months if required.

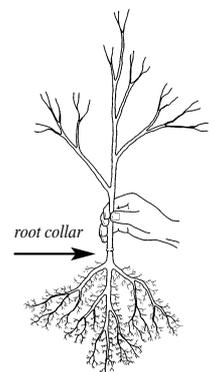
Cell grown stock should be protected from frost, provided the roots are kept moist plants can be stored for several months

4. Pre - planting, stock assessment and plant handling

'Every year, thousands of trees are planted which are already dead , due to careless handling while being lifted and transported to their planting site.' B. Kiser, B.T.C.V. .

A) Assessment of plant condition

Upon receipt, plants should be carefully checked for signs of physical damage and disease. All forms of planting stock should satisfy British Standard B.S. 3936, having a compact fibrous root system, with a good root/shoot ratio with the balance in favour of the roots. (Illustration 6)



6. A bare root plant showing good growth form

The diameter of the root collar can be a useful indicator of quality. Its position on a plant can often be determined by a marked change in colour on the main stem. For example in hawthorn there is a change in the bark from olive to a lighter green/orange. Plants in the size range 30-45cm should have a minimum root collar of 5mm diameter.

Spindly plants and/or those with long single roots and few fibrous roots should be avoided. Look also for scarred stems and evidence of insect or fungal damage.

It should be noted that a positive assessment based on physical characteristics is no guarantee of plant health. Poor handling prior to receipt can severely prejudice plant survival. This may not be noticeable until some time after planting. For this reason it is best to use a reputable nursery to which it is possible to return if large scale dieback occurs with no obvious cause.

B) Upon Delivery

Upon delivery plants should be inspected to establish their condition. Reject any plants which do not meet the criteria discussed above.

Bare root stock should be packed in co-extruded plastic bags (white on the outside, black interior) with the bags tied at the top in order to protect the roots from desiccation. If the roots are found to be dry on inspection but the plants otherwise appear healthy they should be soaked in water before being returned to the bag.

C) During Transportation

During transportation the bagged plants should be carried in a trailer or a well ventilated vehicle to ensure the plants do not overheat. They should be handled carefully to avoid physical damage. If a large number of bags are being transported they should be stood upright rather than stacked on top of one another.

5. Planting Methods

A) Plant Handling

Plants should be handled with care to avoid physical damage. If planting on sunny days bags should be kept in the shade. Bare root plants should be kept in the bag until the moment of planting in order to minimise the dangers of root desiccation.

B) Planting Methods

Notch (or slit) and pit planting are the two main methods of planting trees and shrubs. These are illustrated in Field Boundaries Technical Guidance Card No 2. Notch planting is the commonest approach but is only acceptable where ground conditions are appropriate and /or with the correct type of stock. The use of planting spades is recommended. Specially designed tools have been developed for cell grown stock.

Notch Planting

Advantages

- Quickest option most suitable for lighter soils where the ground has been cultivated.

Disadvantages

- Difficult to ensure that the notch is sufficiently large to accommodate a plant's roots. They must not be constricted at planting but should be spread without being bent back on themselves or broken. (Side air pruned and cell grown stock have an advantage here).

- Difficult to open a notch in hard, stoney soils.

It is an inappropriate technique for use in clay or heavy loam soils because-

- Notches are likely to open exposing plant roots during periods of heavy frost or drought.

- The spade will smear the sides of the notch during planting creating a difficult surface for roots to penetrate.

- It can be difficult to ensure that the soil makes contact with the roots, air pockets left around the roots can cause the death or stunting of the plant.

Pit Planting

Advantages

- The best method for ensuring planting success, pits should be dug sufficiently large to avoid constriction of the plants root system.

- The only option in certain ground conditions

Disadvantages

- Slower.

- Arduous in stoney ground.



7. Placing plants along the edge of the trench prior to backfilling.

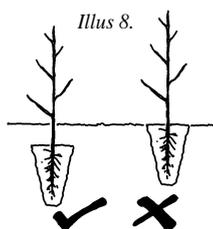
Trench Planting

A traditional approach to hedge planting particularly suitable for two people planting single row hedges. Excavate a trench throwing the earth up on one side, the plants are then lined out at appropriate spacings along the opposite side and the trench backfilled. N.B. The time between the plants being lined out prior to their roots being buried should be minimised. **(Illustration 7)**

Whatever planting method is used you should ensure for bare root transplants that the plant is put in at the same depth at which it grew in the nursery as indicated by the root collar. With cell grown plants it is important to ensure that the plug should be covered by at least 25mm (1") of soil to prevent it drying out and becoming loose in the planting hole.

(Illustration 8)

All plants should be well "firmed" in, to ensure contact between the soil and plant roots.



6. Planting into existing hedges

Planting into existing hedges will involve the use of the same planting techniques as those outlined in the previous section. It is invariably more difficult to undertake as the root systems of in situ plants can make planting physically difficult, whilst the existing plants will compete for light, moisture and nutrients with any new plants. For small gaps it is preferable to lay existing plant material into the gap. These laid stems will then shoot along their length to provide fresh stems to fill the gap. (illustration 9) See Technical Guidance Card 1 Hedgelaying and Coppicing.



9: Stems laid into a gap showing two year old re-growth.

When planting into an existing hedge ground preparation options are largely limited to vegetation control. If herbicides are to be used care must be taken not to spray out the existing hedge plants, freshly coppiced stools are particularly vulnerable. If spraying of hedge base vegetation is to occur it should be undertaken prior to any coppicing activity. **Herbicides should not be used indiscriminately in the bases of old hedges; where the ground vegetation may well be of significant conservation value.** Screefing is a preferable, though more labour intensive option. Due to its competitive nature any elder plants should be cut out and the stumps treated with a herbicide.

Shading is a problem when gapping up hedges. Where the existing plants are not being coppiced some pruning may be beneficial. If planting into small gaps (upto 2 metres) is unavoidable shade tolerant species such as hazel and holly should be used.

Planting into larger gaps where shading is less of an issue should involve a wider range of species. Traditionally blackthorn was used in gapping up hawthorn hedges, there being a widespread belief that hawthorn does not do well when planted into existing hawthorn hedges. The older plants are believed in some way to retard the growth of the new.

A method for planting new trees into existing hedgerows is illustrated on the companion guidance card.

7. Soil ameliorants and root dips

A) Soil ameliorants include artificial fertilisers, manure and peat. As a general rule there is no need to use soil additives in hedge planting schemes, their use in certain circumstances may even be counter productive. Consequently their use is not generally recommended.

B) Root dipping plants into a polymer gel is a service commonly offered by nurseries. The gel is designed to absorb water from the soil holding it in reserve for times of drought. There is limited experimental evidence which suggests that some brands of polymer dip can improve growth and survival rates of plants in the field. However the opinion of the Arboricultural Advisory and Information Service is that,

"These products are unlikely to yield benefits to newly planted trees in terms of survival or sustained growth improvement during long periods of drought. Good weed control is generally the most effective way of minimising moisture stress of newly planted trees." S.J.Hodge

Such treatments may be useful in helping to prevent root dessication during planting. It is an inexpensive operation which most nurseries can arrange to undertake prior to supplying the plants.

8. Plant spacing

For new planting, the County Durham Hedgerow Partnership recommends planting 6 plants per metre. Hedges are generally planted either in single lines with 20cm (8") between plants or in offset rows 40cm (16") apart with 15cm (6") between rows. For interplanting between coppiced sections, 4 plants per metre is usually sufficient.

Spacing between plants should be determined by the likely future management. Closer spacing, in conjunction with an appropriate trimming regime (see Technical Advice Sheet 3 Hedgetrimming), can allow for the production of a dense stock resistant barrier whilst delaying the need for hedgelaying. Hedges to be managed by laying can be planted at lower densities.

Historically in County Durham offset double rows have been the preferred option. Many farmers state a preference for this method suggesting that it provides a stouter barrier, although inevitably some authorities have claimed that a single row planting will provide an equally robust barrier (Vernon 1899, Beddal 1950).

It is worth noting that single row planting is easier to undertake in some situations. Due to the ease of access to the plants it is also simpler to maintain when herbicides or organic mulches are to be used. Single row planting is the best option if it is intended to manage the hedge by laying in a 'single brushed style' (see Technical Advice Sheet 1 Hedgelaying and Coppicing) whilst offset rows are preferable for most northern styles.

9. Pruning

Pruning new hedge plants back to 10-15cm (4" - 6") after the first years growth is a traditional practice undertaken during the dormant season to encourage multiple shoot growth and a bushy growth form (**Illustration 10**). It can also be undertaken immediately after planting and is a useful technique when used in conjunction with a sheet mulch. Most broadleaved plants can cope with pruning but for some species such as hazel and crab apple the response may be less immediate than for hawthorn. Holly should never be pruned in this way. Hedgerow trees should also be left unless specifically seeking to improve their growth form.

Whilst primarily undertaken to encourage a dense hedge bottom, pruning can also be useful when undertaking late plantings of bare rooted stock. By delaying leaf burst the plants water requirements are reduced allowing it more time to establish an effective root network. Note that it is important that plants in leaf should **not** be subjected to this



10. Three months regrowth from stumped back plants, note the multiple stems.

form of pruning as it leads to a severe disruption of root growth, which may be more significant in the longer term than any initial problems with moisture stress.

Pruning can also be beneficial in exposed sites where "windrock" can be a problem. Windrock occurs where the wind causes new plants to socket in their planting hole, this can cause damage to roots and instability in the plant. Cutting back reduces wind resistance and allows the plants more time to establish a stable root network.

A notable disadvantage of pruning in areas of high soil fertility is that adjacent weed growth can physically swamp the new plants.

Hedgelayers are not keen on pruning as the resultant growth form is less suitable for hedgelaying. An alternative which also encourages the development of a dense base is to plant the hedge plants at an angle of 45 degrees all leaning in the same direction along the hedgeline, *pointing uphill if on an incline*. This stimulates the growth of shoots along the stem of the plant which at close spacing will interweave with neighbouring plants. This method is difficult to undertake when using sheet mulches. Note that hedgerow trees should always be planted upright.

10. Aftercare

A) Prevention of Animal damage

Rabbits, hares, deer, sheep, cattle and horses all pose a threat to young trees and shrubs, particularly during the winter months. If any of these are present, or likely to be in the future, the plants will require protection. For livestock a fence will be required. This should be placed far enough from the plants to prevent browsing, usually at least 1m (3' 3") for cattle, 1.5m (4' 10") for horses. (**illustration 11**)



11. A new grant aided hedge with a double line of rabbit fencing for protection.

For rabbits and hares, rabbit fencing is usually the best option. New or existing stock fences can be made rabbit proof by attaching rabbit netting.



12. Wind damage to shelters used on an exposed demonstration site (Hillingdon Farm Teesdale). Rabbit fencing would have been a better option here

Alternatively rabbit guards can be used. All types of guard tend to force plants to grow upwards. This is not an issue where laying is intended but if a dense bushy base is required protection by fencing is a better option. The costs in a high density planting scheme are similar.

Guards are most useful for smaller sections and gapping up. Provided that they are supported in some way they can also offer some defence against

windrock; but if the exposure is significant the guard itself may be a problem by increasing the overall wind resistance of the hedge (**Illustration 12**).

Currently there are 4 main types of guard available. A comparison is shown in the table overleaf.

In some situations the threat from rabbits may be minimal and the use of guards and/or fences undesirable due to the potential for attracting unwanted human attention to the new plants. Stumping plants down to 10cm after planting can be a useful exercise in such areas, reducing their visibility and attractiveness to vandals.

B) The Need for Weed Control

"The fact is that success or failure almost entirely depends upon the preparation of the soil and the removal of weeds as fast as they appear for the first four or five years." Vernon

Weeds, particularly grasses, are extremely effective at competing with trees and shrubs for light, nutrients and water. Broad-leaved weeds on fertile sites can physically overwhelm new plants and retard growth or even kill plants by shading



<i>TYPES OF HEDGE GUARD</i> (Prices quoted per 500)	<i>ADVANTAGES</i>	<i>DISADVANTAGES</i>
Polypropylene wraps (approx 11p - 13.5p per unit, 2003 price)	<ol style="list-style-type: none"> 1. Quickest type to put on in good ground conditions and when plants are not too bushy. 2. Self supporting. 3. Suitable for use where herbicides to be used as the casing protects the plants from spray drift. 4. Can be used with plants which have been stumped back. 	<ol style="list-style-type: none"> 1. May cause root constriction resulting in poorer growth. 2. No use in hard/stony soils. 3. No good for holly, other bushy plants will need side shoots pruning to allow the quill to fit. 4. Plants forced to grow up rather than out.
Spiral guards transparent and coloured (approx 12 - 14p per unit, 2003 price; canes 4-5p) Transparent guards would appear to encourage greater growth rates.	<ol style="list-style-type: none"> 1. Minimal wind resistance useful on exposed sites. 2. Can be fitted around most plants (not holly) though may leave protruding shoots to be consumed by rabbits. 	<ol style="list-style-type: none"> 1. Need to be used with a cane. 2. Relatively slow to put on. 3. Requires care if used in conjunction with herbicide weed control regimes. 4. Not suitable for use with plants which have been stumped back. 5. Bushy plants may need pruning to allow fitting.
Net guards. (approx. 26p per unit, canes 4-5p, may need two)	<ol style="list-style-type: none"> 1. Mesh allows better circulation of air around plant. 2. Can be used with plants which have been stumped back. 3. Some versions come with a skirt to protect against herbicides. 4. Wider body allows relatively easy placement over bushy plants including holly. 5. Allows for bushier growth form than spirals or polypropylene wraps. 	<ol style="list-style-type: none"> 1. Requires two canes in exposed sites or a stake. Guards with solid sections have too much wind resistance for exposed sites. 2. Some versions require special tools to attach canes to guards. 3. Relatively slow to put on. 4. If not properly positioned rabbits can work their way under the edge of the guard.
Mesh guard. (approx. 19p per unit)	<ol style="list-style-type: none"> 1. Allows free air circulation around the plant. 2. No cane required except on exposed sites. 3. Guard fitted prior to planting can be done off-site. 4. The guard and shrub are planted together saving time. 	<ol style="list-style-type: none"> 1. Requires care if used in conjunction with herbicide weed control regimes. 2. Difficult to use on old hedge banks where soil relative compacted. Some people find the wraps comparatively time consuming to put on 3. Some problems experienced in dry conditions; difficulty in firming soil around roots/guard.

them out. Some form of weed control is essential for at least three years or, in areas where establishment and growth is poor (for example on reclaimed land), for five years.

i) Options for weed control

A number of options exist varying in cost, complexity and environmental sensitivity. The simplest option is hand weeding, however this is time consuming and, in the absence of labour, generally only viable for short sections of hedge.

Strimming is occasionally used to control weeds in planting schemes. While this can help prevent plants from being physically overwhelmed and can reduce competition from broadleaved herbs, on its own it is **not** a recommended approach. Where the main competition to new plants is coming from grasses it can be counter productive as grass becomes more vigorously competitive when cut.

ii) Mulches can be effective in suppressing weeds with the added advantages of retaining soil moisture and maintaining a higher soil temperature favourable to root growth. It is important that any vegetation on the site is initially suppressed prior to the application

of the mulch. A number of options are being trialled by the County Durham Hedgerow Partnership at Houghall College Farm and viewing of these can be arranged. The choice of mulch is between sheet mulches made of polythene, polypropylene or various types of natural and manufactured fibre, and loose organic materials such as well rotted farmyard manure, straw and wood chips.

Sheet Mulches

Sheet mulches can be bought from horticultural suppliers and many tree nurseries. They vary in strength, durability and effectiveness. Biodegradable mulches are available and have been trialled by the County Durham Hedgerow Partnership. Whilst effective, they proved to have a very limited lifespan. Polythene and woven polypropylene currently offer the most effective performance overall, the latter being considerably more robust than the former. Whatever material is employed it should be impervious to light.

The emplacement of sheet mulches is time consuming but if correctly positioned they can be highly effective and greatly reduce the need for future input providing that they remain intact.



13. Weeds will readily invade holes in mulches and may as here kill off young plants.

Any holes in the mulch will be exploited by weeds. (**Illustration 13**) This can be a particular problem with pre-laid sheet mulches into which slits are cut to allow planting (see Technical Guidance Card 2). Weed growth through such holes can significantly reduce the effectiveness of the mulch. Initially at least this problem can be avoided by spraying off the planting area prior to the application of the

mulch. Subsequent weed growth can be spot treated if required.

Planting the trees, pruning them back and then placing the mulch over the top, largely avoids this problem as only small incisions are made in the sheet (**Illustration 14**). If the existing ground vegetation has not been sprayed prior to planting the sheet mulch will need to be weighed down with debris around the plants as regenerating weeds underneath the mulch can cause it to lift up over the cut plants.



14. Small incisions reduce the opportunity for weeds to invade the mulch.

Even with a sheet mulch, stumped back plants can be vulnerable to shading out by adjacent weed growth. This is a particular problem on fertile sites. Where this occurs the vegetation must be cut back.

Some problems are peculiar to sheet mulches. The following points need to be considered when contemplating their use.

- a) Voles will sometimes burrow underneath a mulch and strip the bark from new planted trees, whilst foxes have been known to rip up sheet mulches in pursuit of voles. Voles occur most commonly in rank grassland. Vole guards are available to protect plants from their attentions.
- b) Non-breathable mulches made from materials such as polythene and spun bonded polypropylene should not be used on poorly draining sites for example, on heavy soils and reclaimed land. This will include many former opencast sites. As anaerobic conditions may develop under the sheet which can cause the death of the tree.

c) Sheet mulches are often visually intrusive. There is also the issue of what happens to the residue of the mulch after it has outlived its usefulness. Many of the materials sold as sheet mulch take some account of these issues and come in subdued colours made of materials which will degrade over time. For some materials, for

example polythene and polypropylene, this period of decay is of uncertain duration and the residue may ultimately require removal.

d) If extensive beating up (replacement of failed plants) proves necessary this is made more difficult where a sheet mulch is in place. It would be best to beat up with cell grown plants in this situation.

Organic mulches

Organic mulches such as straw, woodchip and well rotted farmyard manure are cheap and readily available to many landowners. They are simple to apply although it is relatively labour intensive work. Experimental evidence suggests that over a one year period they can be as effective as herbicidal control, after that the material will require renewal. For organic mulches to be at their most effective a depth of at least 10cm (4") should be applied onto a weed free substrate. Weeds can colonise these mulches (**Illustration 15**) and vigorous weeds such as thistles may grow through them. Organic mulches can be effective but for long term weed control some hand weeding or occasional spot herbicide application is likely to be necessary. They will require renewing every year for the duration of the maintenance period.



15. Straw mulch used on a plot at East Durham and Houghall Community College.

Chemical control methods

Herbicides are the most commonly used option for weed control in large scale planting schemes. If properly used they can be extremely effective. They have the advantage over most mulches of being initially cheaper and quicker to apply. However over the 3-5 years of a maintenance scheme they can prove to be a more expensive option, depending upon the regime followed.

It is not intended to discuss herbicide regimes or products in detail here, the potential user is referred to Forestry Commission Fieldbook 8 (The use of Herbicides in the Forest) available from H.M.S.O. A few general comments are worth making here. Firstly the person using the herbicides (unless born before 1964) must be a trained operative holding a valid license or working under the direct supervision of a certificate holder in order to comply with regulations concerning the control of pesticides. There is a greater risk to operatives and the environment in the use of these products than any of the alternatives.

The most effective weed control regimes seek to maintain bare earth around the new plants. Assuming the ground is clear of weeds in the immediate aftermath of planting 'residual' herbicides may be applied. These prevent the growth of weed species for a period of time after their initial application. As these start to break





down there is a follow up with a contact herbicide applied directly onto the weed growth. Care must be taken in the use of these as many trees and shrubs are as susceptible to their effects as the target species. Spray guards or weed wipers should be used.

Timing is important in the use of herbicides. Trees and shrubs are particularly at risk from competition between April and June. Whatever regime is used should ensure the control of weeds during this period. Depending upon the rate of weed growth

earlier is better. Applying herbicides after this period if they have not been used previously in the season is often a futile gesture.

A comparison of different approaches to weed control types used on experimental plots by the Durham Hedgerow Partnership, and notes concerning their relative advantages/disadvantages is given below.

<i>WEED CONTROL OPTIONS</i>	<i>ADVANTAGES</i>	<i>DISADVANTAGES</i>
Polypropylene sheet mulch	<ol style="list-style-type: none"> 1. Strong material, easy to cut and position. 2. Cheapest sheet mulch option after polythene. 3. Relatively rip proof especially the woven version. 4. Durable should survive the ideal aftercare period of 5 years. 	<ol style="list-style-type: none"> 1. May cause problems due to constriction of plant stems as plants grow if material is tight around the stem and fails to degrade. 2. Although sold as being photodegradeable seems likely to be fairly persistent at least in the medium term, may need to be removed in the future. 3. Not suitable for use on wet sites.
Polythene sheet mulch	<ol style="list-style-type: none"> 1. Cheapest sheet mulch option. 2. Probably most effective mulch in retaining soil moisture and warming the soil. 3. Heavier grades have good durability. 4. Little maintenance required. 5. Allows unrestricted stem expansion. 	<ol style="list-style-type: none"> 1. Not as robust as polypropylene, requires more care during placement. 2. Tears relatively easily. 3. Photodegradeable BUT likely to be fairly persistent at least in the medium term. Likely to breakdown into shreds. If these are not picked out they may cause a nuisance. 4. Not suitable for use on wet sites.
Fully biodegradable e.g. flax mulch	<ol style="list-style-type: none"> 1. Easy to cut and position. 2. Fully biodegradable so no problem residues to deal with. 3. Can be used on wet sites. 	<ol style="list-style-type: none"> 1. Expensive. 2. In trials only provided weed control for one season.
Partially biodegradable e.g. Wulch	<ol style="list-style-type: none"> 1. Least obtrusive sheet mulch. 2. Relatively easy to use but otherwise little to recommend it. 	<ol style="list-style-type: none"> 1. Most expensive type of sheet mulch trialled. 2. Not wholly biodegradable, may need removal in the long term.
Farmyard manure	<ol style="list-style-type: none"> 1. Cheap and readily available. 2. Reasonably easy to apply. 3. No unsightly residues. 	<ol style="list-style-type: none"> 1. Must be properly composted otherwise will cause weed problems. 2. Not suitable for use on wet sites.
Wood chip	<ol style="list-style-type: none"> 1. Relatively cheap. 2. Easy to apply and re-apply. 3. No unsightly residues. 	<ol style="list-style-type: none"> 1. Must be properly composted, otherwise micro-organisms in the material will compete with the plants for nitrogen as the mulch decomposes. 2. Can be scattered by wind in exposed sites. 3. Least effective organic mulch.
Straw	<ol style="list-style-type: none"> 1. Cheap and readily available. 2. Reasonably easy to apply. 3. No unsightly residue. 4. Most effective organic mulch used in experimental plots. 	<ol style="list-style-type: none"> 1. As the straw rots down micro-organisms will compete with the plants for nitrates. 2. Application fairly laborious.
Chemical control	<ol style="list-style-type: none"> 1. Only option to compete with sheet mulches in overall effectiveness. 2. Cheap in the short term but costs over the life of a scheme compare unfavourably with cheaper sheet mulches. 3. Quick to apply BUT must be undertaken with care if not to be counter productive. 	<ol style="list-style-type: none"> 1. If not applied with care can cause environmental damage and or death to the hedge plants. 2. Should only be used by a trained operator. 3. Applications required at least twice a year to be effective.

Beating up

Beating up is the process of replacing failed plants. Planting schemes should be monitored and failed plants replaced at the earliest opportunity as it becomes more difficult to fill gaps as the hedge matures. Where there is extensive dieback some thought needs to be given to the likely cause in order to avoid repetition of the problem. Most grant schemes will require beating up as a matter of course.

Further advice and information on the issues touched upon in this document is available from Durham County Council (Tel: 0191 3834078) or the Tyne Tees Farming and Wildlife Advisory Group (Tel: 01833 630880). References used in the compilation of the document follow.

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