

Sward enhancement: diversifying grassland by oversowing and slot seeding

Sward enhancement refers to management techniques which aim to increase the botanical diversity (mainly the wildflower component) of species-poor grassland. Such work can be funded under Environmental Stewardship Higher Level Scheme (HLS). Oversowing and slot seeding are two methods of sward enhancement. Other techniques of spreading species-rich green hay and planting pot-grown transplants and plug plants are described in separate information notes.

Key points

- Suitable sites must be selected to ensure the best chance of success.
- Seed must be carefully chosen for a particular site.
- The site should be prepared prior to oversowing to achieve a short sward with 50% bare ground.
- When oversowing, seed must be broadcast on the surface and then bedded in.
- Slot seeding requires specialist machinery, which may have to be adapted, for example, to attach a band sprayer.
- Subsequent site management is important.

Introduction

Not all grassland is suitable for enhancement. The main requirements include low soil fertility and low/no weed burden. Enhancement methods usually involve disturbance to the sward. The benefits of enhancement, must be balanced against the risk of erosion or damage to other features for example, where there is buried archaeology or bird interest. If in doubt consult your Natural England adviser.



Six-spotted burnet moth on common knapweed

For more information see Technical Information Notes TIN061 - *Sward enhancement: selection of suitable sites* and TIN062 - *Sward enhancement: choice of methods*.

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On the right sites, both oversowing and slot seeding can be very effective techniques of diversifying grassland. Oversowing is the more commonly used method, as slot seeding requires specialist machinery.

Timing

Both oversowing and slot seeding should be undertaken in late summer or early autumn (ideally early August to mid September). This favours autumn-germinating species, and seeds of species such as cowslip *Primula veris*, which require a period of cold to break their dormancy before they germinate in the spring.

Later sowings should be avoided because of the risk of frost damage to seedlings. Spring sowings are possible, but many species will not germinate in the first year, and there is greater risk of failure due to drought.

Seed mixes

The species chosen must be suited to the site conditions and should be appropriate for the area. Where possible seed should be of local origin ie collected from grassland close to the site where it is to be sown. Wildflower seed should always be of British native origin.

For more information see Technical Information Note TIN038 *Seed sources for grassland restoration and re-creation in Environmental Stewardship*.

For sites in the early stages of restoration, it may not be worthwhile sowing species which are more difficult to establish – see section on successive sowing.

Weed control

All pernicious weeds present in the sward should be controlled before ground preparation. Any application of herbicide should be by spot treatment or weed wiping to avoid damaging non target species.

Spear thistle *Cirsium vulgare*, ragwort *Senecio jacobaea* and other weeds with wind-blown seeds should be controlled where they occur on

adjacent areas, as they can quickly invade once the sward has been opened up.

Oversowing

The success of oversowing depends on the presence of gaps in the sward which are large and persistent enough for seeds to germinate and establish free from competition. Seeds must land and then be pressed into the bare soil in the gaps with sufficient moisture to germinate and sustain them.

Ground preparation

In the majority of cases, ground preparation will be required prior to oversowing. Sowing onto a closed sward is extremely unlikely to be successful. Seed may fail to come into contact with the soil and die, and any seedlings which germinate may be out-competed by the existing sward.

The starting point is a short sward, created by cutting (with cuttings removed) or grazing. The aim is then to create 50% bare ground, using livestock (the 'hoof and tooth' method) or machinery.

This may seem drastic but research and experience has shown this to be necessary to reduce competition from the existing sward. Within a few months (or even less) the sward will recover and very little bare ground will remain. However, if there are known archaeological sites in the area, consult your historic environment advisor to ensure archaeological features are not damaged.

Where livestock are used to create bare ground, cattle are most effective as their hooves more easily break up the sward. Sheep can also be effective on damp ground. As a guide there should be frequent gaps of at least 10 cm in diameter.

Where livestock are unavailable, or where the ground is too dry for them to be effective, bare ground can be created using a power harrow or set of discs.

Mechanical sward disturbance may release nitrogen from the soil and stimulate herbage

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growth which should be controlled – see section on subsequent management. It may also stimulate the weed seed bank, so it should only be undertaken on sites with very low or no weed burden.

In a few cases, notably in upland hay meadows, there may be sufficient bare ground and soil moisture following the hay cut for seed to be sown without further ground preparation. However, such cases are likely to be rare.

Seeding

The following seed rates are recommended:

- 5-10 kg/ha of a wildflower and grass seed mix (usually including at least 10% wildflower seed).
- 1-2 kg/ha of a pure wildflower seed mix.

Seed can be sown either over the whole field or in patches. Patch sowing may be appropriate where:

- seed is in short supply;
- certain parts of the field are being targeted (for example, areas with lighter soils); or
- there is a risk of soil erosion.

The seed must be sown on or only just below the surface. The most appropriate method is to broadcast the seed using for example, a fertiliser spreader, slug pellet applicator, grass seed box or one of the modern arable seed drills with the coulters lifted up. Slug control may be needed – see later section.

For small areas, seed can be sown by manual broadcasting using a hand-held lawn fertiliser applicator, seed fiddle or seed barrow.

Seeds of different sizes and weights may settle out or become partitioned during sowing, causing a patchy sowing distribution. A more even coverage can be obtained if the seed is bulked up with an inert carrier for example, barley meal, silver sand, fine sawdust, or poultry chick crumbs, and then sown at half rate in two directions. Light coloured carriers make it easier to see which areas have been sown.

Bedding in the seeds

After sowing, seed must be bedded in to ensure good contact with the soil, by trampling with livestock (preferably cattle) or light rolling.

Successive sowing

Successive sowing, which introduces new species over several years, may be a good approach since many plant species vary greatly in their ease of establishment.

TIN050 – *Selecting indicators of success for grassland enhancement* categorises species according their ability to colonise new sites.

Those in Group 1 are relatively easy to establish. It is thought that some of these (for example, red clover) are ‘facilitator species’ which over time can create soil and sward conditions which speed up subsequent colonisation by species in Group 3 which are difficult to establish.

It will often be useful to sow yellow rattle (a Group 2 species) which parasitizes more competitive species, such as white clover, perennial ryegrass and Yorkshire fog but seed must be very fresh (For more information see TIN060 *The use of yellow rattle to facilitate grassland diversification*).

In the early stages of restoration the cost of sowing Group 3 species may not be justified.

Successive sowing will not be appropriate every year, as plants should be given time to establish before the sward is disturbed again. Some of the introduced species may not appear in the sward for several years, so the success of sward enhancement should not be judged too soon.

Slot seeding

Slot seeding was originally developed as a technique for increasing the productivity of grassland by introducing species such as white clover *Trifolium repens* and ryegrass *Lolium perenne*. The method has been used with some success to introduce wildflowers.

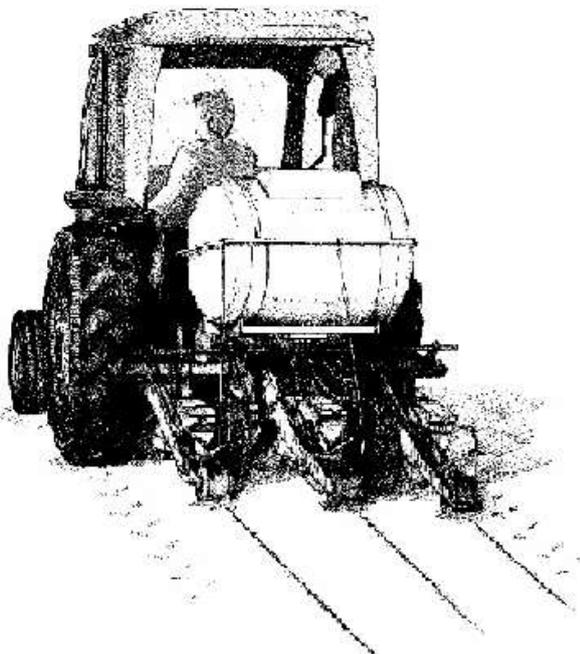
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Slot seeding requires specialist machinery which drills seed into shallow slots, up to 15 mm deep, cut into the turf. Suitable machinery includes:

- a sugar beet drill (for example, Stanhay/Gibbs drill);
- a Howard Rota seeder; and
- a Gallagher/Aitchison Seedmatic.

Normal arable direct drills are usually unsuitable, either because they are unable to penetrate hard ground, or they bury seed too deeply. In addition, these drills are not designed to create gaps or to reduce sward competition.

It is essential to control competition from the existing sward in order for seedlings to establish and survive. The best means of doing this is by fitting the slot seeder with a band sprayer which applies a narrow strip of contact herbicide to the sward at the same time as the seed is sown.



Slot seeding with adapted Stanhay/Gibbs drill

Some machines have a rotovating attachment, which serves a similar purpose by removing the existing sward. However, rotovating may release nitrogen from the soil and stimulate the weed seed bank.

A major advantage of slot seeding is that good results can be achieved with very low seed

rates. However, the stripes of the drill lines may be visually unappealing and can take several years to disperse. The use of herbicide or a rotovator also risks the loss of desirable species from the sward.

The method is not recommended on poorly drained soils because slots can smear or fill with water, and there is a greater risk to seedlings of slug damage and damping off. It is also unsuitable where there are visible archaeological features.

Ground preparation

Before slot seeding create a short sward by cutting (with the cuttings removed) or hard grazing. Allow the sward to green up slightly to provide a target for the herbicide.

Seeding

Avoid undertaking the work when the ground is too hard or too wet.

A wildflower seed rate of 1-2 kg/ha is recommended. Seed should be bulked with a suitable inert carrier to aid spreading.

Where lines are widely spaced, ie >30 cm apart, consider cross drilling at half rate in two directions.

Successive slot seeding

Successive slot seeding is not recommended because of the risk of destroying the plants already introduced.

Slug control

Slugs can devastate wildflower seedlings and populations should be carefully monitored. Control is particularly likely to be necessary when slot-seeding as slugs will readily follow the sown strips and eat the seedlings.

Rolling can help control slugs. Alternatively, slug pellets can be used - ideally drilled into the slots at the time of seeding. Slug pellets must be used in accordance with statutory instructions and directions for use on the product label. For land in agri-environment scheme agreements, prior approval will be needed from your local adviser.

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Subsequent management (both methods)

In the period immediately after sowing (usually September - November), the sward should be kept short so that light can help germination.

This is best done by short periods of intensive grazing. Alternatively the sward can be cut and the cuttings removed. Prolonged grazing should initially be avoided in order to reduce the risk of seedlings being selectively grazed.

In the first spring, it may be necessary to cut or graze the sward to prevent seedlings being shaded out by the existing vegetation.

A short period of intensive grazing, or cutting (with the cuttings removed) is recommended. However, this may not be appropriate on all sites and care should be taken to avoid damage to other interests on the site, for example, birds and invertebrates.

Any perennial weeds which have colonised should be controlled early on, for example, by spot treatment with herbicide. Any annual weeds are likely to be controlled by the regular cutting or grazing outlined above.

Subsequently, if the field is to be managed as a hay meadow it should be cut late (for example, after mid July), with swath turning or tedding undertaken to assist seed shedding. The use of livestock, particularly for aftermath grazing, is important because they create gaps in the sward and trample in the seed, which helps the introduced species to spread.

Where the field is managed as pasture, plants must be allowed to flower and set seed by reducing the grazing pressure for a period of about eight weeks in spring and summer.

Inorganic fertilisers or widespread application of herbicides should not be applied after sowing or seeding.

Commitment to an appropriate long term management is essential if a grassland

enhancement project is going to succeed and be maintained.

Further information

Natural England Technical Information Notes are available to download from the Natural England website: www.naturalengland.org.uk. In particular see:

- TIN035: Soil sampling for habitat recreation and restoration in agri-environment schemes
- TIN036: *Soils and agri-environment schemes: interpretation of soil analysis*
- TIN038: *Seed sources for grassland restoration and re-creation in Environmental Stewardship*
- TIN060: *The use of yellow rattle to facilitate grassland diversification in agri-environment schemes*
- TIN061: *Sward enhancement: selection of suitable sites*
- TIN062: *Sward enhancement: choice of methods*
- TIN063: *Sward enhancement: diversifying grassland by spreading species-rich green hay*
- TIN065: *Sward enhancement: diversifying grassland using pot-grown wildflowers or seedling plugs*

For further information contact the Natural England Enquiry Service on 0300 060 0863 or e-mail enquiries@naturalengland.org.uk.

This note does not supersede prescriptions in agri-environment scheme agreements. If there is any conflict between the information in this note and your agreement please contact your Natural England Adviser.

Authors and contributors

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