

The use of yellow rattle to facilitate grassland diversification

In the last sixty years England has lost most of its species-rich semi-natural grassland. Increasing the numbers and species of native wild flowers in semi-improved grassland (ie grassland that has undergone some agricultural improvement) can go some way to restoring this valuable habitat. This note gives advice on how yellow rattle *Rhinanthus minor* can help other wild flower species establish in semi-improved grasslands, particularly in grasslands being managed under Environmental Stewardship. Other notes on enhancing and recreating semi-natural grasslands are available and details can be seen below.

Environmental Stewardship is an agri-environment scheme that provides funding to farmers and other land managers in England. A key option in the Environmental Stewardship Higher Level Stewardship Scheme is the restoration of species-rich, semi-natural grassland (HK7) normally from semi-improved swards.

The botanical diversity of such grassland may be enhanced by simply amending management practices, for example changing the timing and intensity of grazing. However, on sites where the potential for natural regeneration and re-colonisation of desirable plant species is judged to be low, then pro-active restoration will be required. This will involve the introduction of seeds and the creation of gaps in the sward to allow them to establish.

Seeds can be introduced by over sowing, slot seeding or the spreading of green hay. Yellow rattle is often a component of seed mixtures and of green hay, but on some sites there are good reasons for specifically establishing yellow rattle before sowing other wildflower species as it can help improve the chances of the other species eventually establishing.

Yellow rattle - ecology

Yellow rattle is an annual wildflower that obtains some nourishment by parasitizing its host but also photosynthesizes, the term for this is hemiparasitic.



Yellow rattle

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Yellow rattle is native to the UK and can be found in a wide range of grassland habitats. It is particularly associated with semi-natural species-rich neutral hay meadows especially National Vegetation types:

- northern hay meadows (MG3);
- flood meadows (MG4);
- lowland hay meadows (MG5); and
- water meadows (MG8).

It can occur on a wide range of soil types but is normally absent from sites with a pH less than 5.0.

It lacks a long term persistent soil seed bank and is dependent on annual establishment from seed produced the previous year.

Seeds generally germinate in spring (February-April depending on altitude) after a period of chilling to break dormancy. It flowers from early May onwards and most plants will have set seed by early July in the lowlands and by mid to late July in upland areas.

Yellow rattle has a limited dispersal but distances can be increased through the hay making process. The viability of seed decreases rapidly with storage.

It parasitizes a wide range of grass and wildflower species but performs particularly well on grasses and legumes. Consequently, it has the potential to reduce the vigour and biomass of its hosts and hence overall grassland sward productivity.

Use of yellow rattle as a practical management tool for grassland diversification

The presence of yellow rattle in grassland should reduce the biomass of the dominant grass species. This should reduce competition and allow wildflower species an opportunity to become established.

There is increasing evidence that yellow rattle also effects below-ground soil processes such as the rate of nitrogen cycling and the composition of the soil microbial community.

However, it is not clear yet how this might impact vegetation community composition and development.

Establishing yellow rattle before other wildflower species are introduced is particularly suited to situations where either:

- The soil is at the higher end of the recommended range for phosphorus ie soils with a P Index of 2. For further information see Technical Information Note 061 - *Sward enhancement: Selection of suitable sites*. Or
- The vegetation of the site, while fulfilling the targeting criteria, has a significant cover of competitive species such as perennial ryegrass, Yorkshire fog and white clover and/or is very productive.

On sites that are identified as being suitable for species rich grassland restoration (see site selection below) it should not be necessary to establish yellow rattle before other wildflower species.

Target vegetation type

The use of yellow rattle will be most appropriate where the target vegetation types for restoration are species-rich neutral grassland conforming to the NVC types mentioned above ie MG3, MG4, MG5 and possibly MG8.

It may also be feasible to use yellow rattle where the aim is to restore species-rich calcareous pasture (see section on subsequent management) but only where it is practical to have a temporary period of cutting management to ensure the yellow rattle establishes. Grazing can be done in late summer after the yellow rattle has seeded.

Site selection

Technical Information Note TIN061 - *Sward enhancement: Selection of suitable sites*, and the key in the FEP feature manual (Natural England 2008) (botanical enhancement potential of species-poor grassland) provide guidance on the selection of suitable sites for restoring to species-rich, semi-natural grassland. Following this guidance should ensure highly productive

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existing swards are not targeted as these are not likely to succeed.

Yellow rattle may fail to establish in very productive, intensively managed grassland swards due to its failure to compete with established competitive species such as perennial rye-grass (*Lolium perenne*).

Site preparation

Before introducing yellow rattle seed in late summer/early autumn create a short sward with frequent patches of bare ground at least 10cm in diameter (see also Technical Information Note TIN064 - *Sward enhancement: diversifying grassland by over sowing and slot seeding*).

This can be done by cattle grazing (the hoof and tooth method) or, if livestock are unavailable, by using mechanical means such as a power harrow or a set of discs.)

Evidence from restoration of upland hay meadows in the North Pennines suggests that using machinery is a more practical option.

Seeding

The recommended sowing rate for yellow rattle is between 0.5 - 2.5 kg per ha with the target of establishing a density of between 100 to 200 yellow rattle plants per m². At this density there should be a significant reduction in the competitiveness and productivity of the sward.

A general guide is that the greater the productivity of the sward, the higher the sowing density required. Higher seeding rates of 30 kg per ha (1000 seeds/m²) have been advocated to ensure successful establishment (see Westbury and others 2006) but cost would preclude using this rate except possibly on small sites. In 2009 the cost of yellow rattle seed was around £190 per kilogram.

Alternatively, yellow rattle can be introduced via green hay from a donor site which has a significant concentration of yellow rattle. The disadvantage of this is that it can be difficult to achieve the required seeding rate as a high proportion of seed will be lost during harvesting.

It will also result in other wildflower species being introduced simultaneously, although there is no reason why this should be a problem.

Seed should be broadcast over the sward surface late summer /early autumn using, for example, a fertiliser spreader or a seed drill with the coulters lifted up (see Technical Information Note TIN064 - *Sward enhancement: diversifying grassland by over sowing and slot seeding*). This should be followed by cattle grazing to press the seed into the soil. If cattle are unavailable, then a flat, light roller should be used.

It is vital that fresh seed (produced in the same season it is sown) from a reliable supplier is used.

On sites that are next to an SSSI or an existing species-rich semi-natural grassland, the seed should be of local origin. Elsewhere it should be of British origin as per the guidance provided in Technical Information Note TIN038 - *Seed sources for grassland restoration and re-creation in Environmental Stewardship*.

For advice on introducing yellow rattle via green hay see Technical Information Note TIN063 - *Sward enhancement: diversifying grassland by spreading species-rich green hay*.

Subsequent management

Allow yellow rattle to set seed by a taking a late hay cut (from early July to late July depending on altitude) followed by aftermath grazing. Fields normally managed as pastures should be managed as hay meadows during the initial establishment phase.

Once yellow rattle has reached the desired density of between 100 and 200 yellow rattle plants per m² additional wildflower species can be introduced. The time taken to reach the desired density will depend on a number of factors, including the initial seed rate, but is likely to be at least 2-3 years.

Advice on introducing wildflower species by over sowing/hay spreading can be found in Technical Information Note TIN064 - *Sward enhancement: diversifying grassland by over sowing and slot seeding* and Technical Information Note 063 -

The use of yellow rattle to facilitate grassland diversification

Sward enhancement: diversifying grassland by spreading species-rich green hay.

In the years following the sowing of additional species continue to manage the site as a hay meadow. This will help maintain a high density of yellow rattle. However, the dispersal and establishment pattern of yellow rattle is notoriously stochastic (random) so expect fluctuating populations with swathes moving around a field for no apparent reason.

Pasture management (grazing) will eliminate yellow rattle so where the target habitat is a neutral or calcareous pasture the timing of the resumption of pasture management will depend on the establishment of the other wildflower species.

Methods of reduction

In the event that yellow rattle becomes so abundant it reduces hay yields to an extent that it is not worth cutting, it can be controlled by cutting all or part of the field in early June, prior to seeding.

Although, yellow rattle has been suspected of being poisonous to livestock, there is very little evidence that this is actually the case, even when it is abundant in hay.

The application of low rates of farmyard manure (ie no more than 12 tonnes/ha/year every other year) can also help to reduce the dominance of yellow rattle. However, this practice is not recommended for sites undergoing restoration under HK7.

Further information

Natural England publications are available to download from the Natural England website: www.naturalengland.org.uk. In particular:

- Technical Information Note TIN061 *Sward enhancement: Selection of suitable sites*
- Technical Information Note TIN064 *Sward enhancement: diversifying grassland by over sowing and slot seeding*
- Technical Information Note TIN063 *Sward enhancement: diversifying grassland by spreading species-rich green hay*

- Technical Information Note TIN065 *Sward enhancement: diversifying grassland using pot-grown wildflowers or seedling plugs*
- Technical Information Note TIN038 *Seed sources for grassland restoration and recreation in Environmental Stewardship*
- Technical Information Note TIN050 *Selecting indicators of success for grassland enhancement*
- Natural England (2008) *Higher Level Stewardship Part B Farm Environment Plan (FEP) Features Manual* 2nd Edition

For enquiries please contact the Natural England Helpline on 0845 600 3078 or email enquiries@naturalengland.org.uk

Author and contributors

This note was written by Richard Jefferson at the suggestion of Richard Brand-Hardy (DEFRA).

The note has benefited from comments from Tim Barfield, Brendan Burley, Morwenna Christian, Miles King, Harry Kay, Richard Keirby, Adam Kwolek, Rachel Lomas, Dave Martin, Steve Peel, Clare Pinches, Deborah Rusbridge, Ian Slater, Graham Walsh (all Natural England), Richard Brand-Hardy (DEFRA), Val Brown, Claire Cornish (Cumbria Wildlife Trust), John O'Reilly (North Pennines AONB Partnership), Roger Smith (University of Newcastle), Stuart Smith (CCW) and Duncan Westbury (Centre for Agri-environmental Research, University of Reading). Editor Susie Smith, photograph James Simpson.

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The use of yellow rattle to facilitate grassland diversification

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