

## How to encourage pollinators on farms

### Introduction

As well as honey bees, there are many groups of native pollinators in the UK, including solitary bees, hover flies, bumble bees, butterflies and moths.

Since the 1950's the distribution and diversity of the main pollinator groups has declined but a lack of regular and standardised monitoring for wild bees and hoverflies means the changes in abundance are not clear<sup>1</sup>.

The Bumblebee Conservation Trust quotes that 2 out of 24 species of bumblebee have disappeared from the UK since the start of the 21<sup>st</sup> Century, and 2 further species, the Great Yellow bumble bee and the Shrill carder bee are only present in small numbers. They suggest the decline is linked to the loss of wildflower rich habitat such as hay meadows and wildflower grasslands. There are estimates of a 97% loss of wild flower rich grasslands since the 1930s and what is left is often fragmented leading to the isolation of insect populations<sup>2</sup>.

Buglife, a conservation trust for invertebrates in general also state that pollinators are in real trouble:

- Seven bumblebee species have declined by more than 50% in the last 25 years
- Two-thirds of our moths and 71% of our butterflies are in long term decline.
- Across Europe 38% of bee and hoverfly species are in decline; only 12% are increasing<sup>3</sup>.

Wild pollinators have an economic value in the pollination of cash crops but also a value to the pollination of native plants and the pleasure they give to their observers. University of Reading research by Tom Breeze<sup>4</sup> has suggested that wild insect pollinators such as bumble bees, hoverflies and solitary bees make a bigger contribution to UK crop pollination than was previously thought as the numbers of honey bees have crashed since early 1980s. Insect pollination is estimated to be worth £400 million per year to UK agriculture.

Pollinators such as bumblebees need nectar and pollen between early spring and summer and some areas of undisturbed and tussocky grassland for nesting and refuge. Some pollinators require specific plants in their habitat for different stages of their life cycle to feed, e.g. the larvae of the marsh fritillary butterfly only feed in the bases of clumps of devil's bit scabious, Field Scabious and also Small Scabious<sup>5</sup>. Bumblebees require plants such as clovers, vetches and trefoils to supply the high quality pollen they feed to their young<sup>2</sup>.

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## Pollinator Supporting Habitats

### 1. Wild flower meadows

This is a broad description for fields consisting of diverse grassland with a high content of flowering plants. They are typically cut for hay rather than silage or maybe grazed at a low stocking rate. They can be very important when combined with other habitat types such as wood land, hedgerows and wet lands rather than single isolated fields.

They have slowly disappeared through agricultural improvement such as drainage, ploughing, re-seeding, fertiliser treatment, slurry application, conversion to arable and a shift from hay-making to silage production.

In some cases they have been difficult or awkward to manage so have been abandoned to scrub and eventually become wooded. Too heavy grazing pressure also changes plant species and diversity.

### 2. Hedgerows

Hedgerows are important for invertebrate and wildlife conservation in general over large area of the UK. They provide protection and connection through the countryside for wildlife and provide feed and refuge for insects including pollinators.

Lack of suitable management of hedgerows can result in them changing into linear woodland. The lack of a re-laying cycle leads to hedgerows with gaps and even large holes; too frequent and too severe cutting removes cover and food sources.

### 3. Field margins and plots

Cereal field margins or plots are strips of land lying between cereal crops and the field boundary, which are deliberately managed to create conditions which benefit key farmland wildlife species including pollinators. This includes flower rich margins and plots which may be supported financially by Countryside Stewardship. The scheme has options in both mid and high tier agreements and in particular has a suite of options called the 'Farm Wildlife and Pollinator Package' aimed at mid-tier applicants.

### 4. Mixed habitats

The provision of winter and summer invertebrate habitats close together can be beneficial. Hedges and woodland can provide important over-wintering sites for invertebrates (including for crop pest parasites and predators) and margins or plots with high flowering plant content provide good summer habitat. However establishing flower mixes near high hedges and trees will be more difficult due to the resulting shading.

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## Pollinator and insect friendly farm practices

### Pesticide Use

Reduced pesticide use on organic farms already provides a benefit to wildlife in general.

On non-organic farms use of insecticides should be considered carefully. Integrated Pest Management, (IPM), encourages farmers to use the tools similar to those employed on organic farms and to consider the alternatives to crop spraying. These options include the use of crop rotations, shifting planting dates, creating a more diverse farming environment to encourage predators, growing pest resistant varieties and the use of cultivation techniques.

Crops sown into a well-prepared seedbed will be better able to establish and grow away from pest attack; some pests such as leatherjackets can be killed by seedbed cultivations and their movements restricted by good rolling of the seed bed.

Pest predators can be encouraged by growing field margins with tussock forming grasses, creating beetle banks particularly in large fields, leaving some weeds within the crop, and reducing soil cultivations. Beetle banks can be formed on raised banks created using a plough.

### Hay Meadow Management

Traditionally hay meadows were cut late in the year (July on) and carrying on this tradition gives time for flowering plants to go through their reproductive cycle and set seed. When they are mown it is important to leave an uncut headland or other refuge areas for invertebrates and insects to continue to feed and take cover once the hay is cut. Aftermath grazing can also benefit invertebrates, by providing patches of dung for feeding and to create patches of bare and disturbed ground. These fields often had low application rates of farmyard manure and even occasionally some lime with no harm to the biodiversity. It is important to allow plants to flower and set seed as many flowering plants in the hay meadow will be annuals and so can be lost quickly if prevented from seeding back into the sward. Late cuts allow invertebrates to complete their life cycle and many insect larvae develop in the seed-heads of grasses and flowering plants.

Ideally the grassland management should achieve a mosaic of different sward heights. Medium to tall vegetation tends to support more invertebrate life than will short swards that have been closely grazed down or mown too low. However neglected grassland can become rank and less floristically diverse. Allowing plants to flower and set seeds is important, as is allowing a number of grass and flower seed-heads to survive throughout winter.

Light grazing can produce an ideal mosaic of grassland structures with a mix of short swards and longer more tussocky swards.

Cattle tend to provide better management for invertebrates as they graze less evenly than sheep and disturb the ground more, providing a greater range of grass

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heights and habitats. Their dung is good for invertebrates and the cowpats are deposited randomly over the field. Cows avoid grazing around their own dung (called the zone of repugnance) which results in areas of taller vegetation scattered across a field. Avoid sheep grazing in the summer months as they may selectively graze on the flowering plants.

Mowing flower meadows produces a sward of uniform height and an entire site should not be cut all at once as this removes in one quick event all the cover and food supply for invertebrates. Cutting on a rotation across a site provides a patchwork of different sward heights and a more varied structure which benefits invertebrates. Leaving islands of tussocky vegetation provides shelter and overwintering sites.

Maintaining a low nutrient status is important to preserve the flowering plant content and diversity of grasslands so artificial fertilisers should be avoided. Livestock should not be fed out as this increases nutrients in spot areas as well as causing soil structural damage.

Certain flowering plants do not cope well with competition from more aggressive plants which are favoured by high fertility soils. Creating areas of low fertility will help these plants to thrive, in particular by reducing phosphate levels in the soil. This can be done by repeatedly cutting an area for hay or silage and not adding back any fertilisers or manures. Obviously these areas will eventually become very unproductive so be prepared for this.

Dropping fertility will favour fine, open growing less leafy grasses such as bents, fescues, foxtails and sweet vernal which do not compete so aggressively with flowering plants.

## **Improving existing grassland**

Existing species in poor grasslands can be improved by stitching in seed of local native plants. This is best done in late summer to early autumn. Graze the existing grassland down hard, preferably with sheep or after a hay cut to reduce the competition. Directly before sowing harrow thoroughly, ideally with a spring tine harrow to remove any thatch and to scratch the soil surface. Sow onto the surface with a fertiliser spinner or grass seed box and roll the seed in well. Livestock may also be used to trample the seed into the soil. As seed volumes are very small mixing in with a carrier such as saw dust will help with the seed application. Keep competition down from the existing sward by grazing until signs of germination.

## **Hedgerow management**

Hedgerows should be cut in rotation to leave ample blossom over the spring and berries over the summer and autumn. Allow a broad and deep hedge to develop that provides plenty of refuge as well as feed sources for both insects and birds. There is not a particular safe period for cutting to protect insects as hedgerow plants are used all year round; some insects overwinter in old stems and eggs or cocoons overwinter on twigs.

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Hedges should be cut only in sections or only one side in any year to leave cover and feeding sites. They should not be cut annually (unless a roadside safety issue) and ideally only every three or more years to create a hedge with abundant flowers and a diverse structure. Late winter is the best cutting time in general after most berries have gone.

A cycle of hedge re-laying is ideal for hedge management as it provides an age structure of woody plants. The laying rotation around the farm will depend on the tree or shrub species present and the growing conditions but is typically every 15-20 years.

Hedge banks are important for solitary bees and bumblebees in particular for nesting sites. Bare earth banks, some scrub with sheltered south facing aspects can further provide for invertebrate and insect diversity. Earth banks are ideal nesting sites for certain species of bee.

Hedge bottoms are also important as the plants they contain will be sources of pollen and nectar. These hedge row plants can be well accommodated by leaving wide margins and not cultivating and spraying up close.

## **New hedge-row planting**

When planting a new hedge use a diverse species mix of trees and shrubs – oak, hawthorn, blackthorn, dog rose, field maple, buckthorn, Guelder rose, etc. Ditching and banking before planting will provide for a more complete habitat, by creating damp and dry warm areas.

## **Field margins and plots**

### **1. Choosing the site**

Field margins are best sown on the south side of a hedge where there will be less shade. Avoid high fertility areas that allow competitor plants, such as tall coarse grasses, to thrive at the expense of flowering plants. Check the soil pH and only sow plants tolerant of your soil pH range.

So avoid north and east facing slopes and try to use areas that have nutrient poor soils with low phosphate levels particularly important.

Reducing fertility can be done by continuous hay cutting and not returning any manures or fertilisers. An alternative is to grow crops such as phacelia and buckwheat and cut and take away all the material from the site.

Reducing fertility in this manner can be a slow process and may take several years. If the soil is fertile more intensive weed management is likely to be needed post sowing.

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## 2. Establishing the mixture

The stale seed-bed technique will help to control weeds ahead of sowing. A seedbed is cultivated and consolidated as soon as possible after harvest to cause weed seeds to germinate. By creating this tilth but delaying planting, weed seed germination is encouraged. Weeds emerging following tillage are killed by two or more additional shallow cultivations at weekly intervals. The seed mix should be sown immediately after the final cultivation. The vast majority of weed seeds germinate from the top 5cm of soil. If using a false seed bed the weed killing tillage should be shallow, less than 5cm so more weed seed is not brought to the surface.

As most wildflower seeds are small create a fine and firm seedbed, rolled well before sowing. Ideally sow onto the surface using a grass-seed box or small areas by hand. A fertiliser spinner can be used but as the seed rates are low (typically 10-20 Kg per hectare) a carrier will be needed such as sawdust. Drilling is likely to bury the seeds too deep. After sowing roll the seed in well.

Autumn sowing (August and September) usually works well with seeds able to germinate in a warm soil and with a lower weed challenge.

## 3. Management of newly sown sites

Newly established sites will need careful management to control weeds and to prevent them being dominated by competitive grasses. Mowing needs to be done carefully as insect cover is being removed very quickly. By mowing sections in rotation some cover is maintained and a structural variation in plant heights and maturity is created. When mowing cut down to 10 cm and remove the arisings (cuttings). Long vegetative cover over winter is an important refuge for overwintering invertebrates

Allow some tussock forming grasses to develop as these are good refuges for invertebrates.

## 4. Other benefits

With consideration wild flower headlands and plots can have benefits other than just encouraging pollinators. They can provide refuge and feed supply for natural predators and parasites of crop pests.

Although not completed yet there are signs from HortLINK Project HL1092 (Ecostac project) that across a crop rotation there can be increases in yields of cereals, peas and cabbages when grown alongside carefully designed flower mixes<sup>6</sup>.

Flower rich plantings can be a useful provision as buffers alongside ditches and waterways. Awkward corners and poor yielding areas can be utilised for pollinator friendly plants with-out great loss to a farm but obviously cold, wet and shaded areas will be difficult to establish with flowering plants.

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## Selecting a wild flower seed mix

There are important factors to consider when selecting a wild flower seed mix:

- Some flowering plants can favour crop pests
- Some plants are difficult to establish on improved agricultural land
- 'Off the peg' mixes often provide little provision for crop pest predators, such as lacewings, ladybirds, ground beetles.

Companion grasses should be non-aggressive with fine stems and more open habit so they do not out-compete the flowering plants, such as bents, fescues and timothy. Select locally adapted plants if possible and plants that have a wide variety of flower shapes and sizes to suit a diversity of insect mouthparts. Bee friendly plants tend to be blue or purple as bees don't see in the red end of the light spectrum.

The Ecostac project<sup>7</sup> is a 5 year partnership with the horticultural industry, levy bodies and retailers led by Prof Felix Wackers of Lancaster University. It aims to use flowering plants in field margins to promote insect diversity to the benefit of growing crops in a more sustainable and environmentally friendly manner. The project has produced a database of flowering plants that can help in the selection of a seed mix tailored to suit your farming conditions.

Plant seed selection should consider:

- Will it provide for pollen and nectar
- Is it easy to establish on soil type and conditions
- Will it provide habitat, refuge and food for farm birds and pollinators
- Will it encourage crop pest predators and not provide for crop pests

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## Example flowering species to support pollinators and natural pest enemies

Plant Name	Flower provides	Benefits to
<b>PERENNIALS</b>		
Fennel	Good nectar source & late flowering	Hoverflies, parasitic wasps and crop pest predators.
Yarrow	Flowers accessible to many insects	Insect diversity in general including bees, hoverflies and crop pest enemies
Oxeye Daisy	A wide flowering period of May-September	Hoverflies, bees, butterflies and general insect diversity
Bird's foot trefoil (Common & Greater)	Good for nectar Greater birds foot trefoil is a wetland plant	Bees and insect diversity Larval food plant for moth species
Red Clover	Good nectar and pollen	Birds, bees and insect diversity
White clover	Good nectar and pollen	Birds, bees and insect diversity
Bush Vetch	Good nectar	Bees, pest predators and parasites, insect diversity & farmland birds
<b>ANNUALS</b>		
Cornflower	Good nectar	Farmland birds, bees, hoverflies, pest parasites & predators
Borage	Good nectar source	Farmland birds, bees, hoverflies, pest parasites & predators
Common vetch	Good nectar	Birds, bees and insect diversity
Buckwheat	Excellent nectar and pollen	Birds, bees, hoverflies, parasitic wasps, pest predators and insect diversity
Teasel	Good nectar source for bees	Particular benefit to birds and general insect diversity. Adds height structure to flower mix.

## Support for Pollinators area under Countryside Stewardship

The establishment of wild flower plots and margins can be used to meet a farm's obligations by qualifying for Ecological Focus Areas (EFAs) and may be financially supported by options under Countryside Stewardship. In particular the Pollinator and Wildlife package will receive additional points to help a holding's application for mid-tier Countryside Stewardship. There are several options in the Stewardship scheme to finance the establishment of pollinator friendly plants, all available in both mid and higher tier applications.

- AB1 – Nectar flower mix
- AB8 – Flower rich margins and plots
- GS4 – Legume and herb rich swards
- AB11 – Cultivated areas for arable plants

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## References:

<sup>1</sup> Status and Value of Pollinators and Pollination Services.

A REPORT TO THE DEPARTMENT FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS (Defra) ID PH0514 July 2014 ver. 3 Authors: Dr Adam J. Vanbergen<sup>1</sup>, Dr Matt S. Heard<sup>2</sup>, Dr Tom Breeze<sup>3</sup>, Prof. Simon G. Potts<sup>3</sup> and Prof. Nick Hanley<sup>4</sup>

<sup>2</sup> [Bumblebeeconservation.org/about-bees/why-bees-need-help/](http://Bumblebeeconservation.org/about-bees/why-bees-need-help/)

<sup>3</sup> [Buglife.org.uk/bugs-and-habitats/pollination](http://Buglife.org.uk/bugs-and-habitats/pollination)

<sup>4</sup> T.D. Breeze, A.P. Bailey, K.G. Balcombe and S.G. Potts, Pollination services in the UK: How important are honeybees?, *Agriculture, Ecosystems & Environment*, published online 20 May 2011, doi:10.1016/j.agee.2011.03.02

<sup>5</sup> <http://www.ukbutterflies.co.uk/species.php?species=aurinia>

<sup>6</sup> Perennial field margins with combined ecological and agronomical benefits for vegetable rotation schemes - HL0192 <http://randd.defra.gov.uk/Default.aspx?Module=ProjectList&AUD=1315>

<sup>7</sup> [http://www.ecostac.co.uk/seed\\_list.php](http://www.ecostac.co.uk/seed_list.php)