

Scottish Natural Heritage

Managing Arable Farmland for Wildlife

Replacing the benefits of set-aside





Introduction

This booklet highlights some of the concerns that have been raised about the impacts of the loss of set-aside on the wildlife of arable farmland and looks at some options for replacing biodiversity and providing other benefits. This includes options that may be available under grant schemes as well as adjustments to farm management that could be implemented at little or no expense.

A number of case studies are provided showing successful management for wildlife conservation that has been integrated with commercial arable production at farms throughout eastern Scotland.





Arable wildlife and the benefits of set-aside

Wildlife on arable farmland

The population index of farmland birds has declined by around 50% across the UK since 1970 while bird populations in general have remained relatively stable (BTO, RSPB, Defra). There are similar concerns about declining populations of formerly widespread arable plants such as the cornflower and corn marigold and of insects such as butterflies and bumblebees on arable farmland. As the value of insect pollinators for crops has been estimated at £440 million per annum across the UK – 13% of overall income from farming¹ – these biodiversity losses could have significant economic as well as ecological implications.

There is little doubt that the primary factor driving these declines has been the intensification of farming that started in the 1970s. Farm specialisation and simplification, increased pesticide inputs, the increase of winter cropping and the drainage and improvement of semi-natural habitats are all factors that have been associated with a reduction in farmland biodiversity.

Set-aside

The introduction of set-aside in 1992 was intended as a market control mechanism in response to the 'grain mountains' of the 1980s. As most set-aside received fewer crop protection and fertiliser inputs and lower levels of disturbance from machinery than arable crops, they

often provided a more botanically and structurally diverse habitat than adjacent crops which in turn led to enhanced populations of plants, insects and the birds which fed on them.

Not all set-aside was beneficial to wildlife, but the sheer scale of land involved (around 15% of the arable area of Scotland – 80-100,000 hectares) meant that this relatively blunt instrument was likely to be of significant benefit to arable biodiversity.

Since the demise of compulsory set-aside in 2008 (only 20,000 ha of set-aside type habitats remained in 2009) there has been considerable concern about the impact on biodiversity. A conservative estimate suggests that the area lost supported at least half a million bumblebee nests². With an increasing emphasis on food security it will be necessary to deliver benefits to wildlife through much more targeted and efficiently used measures.

Requirements of arable wildlife

In the case of farmland birds, research has led to the development of a concept of halting and reversing these declines through implementation of a suite of measures that deliver the 'Big Three'³. As this strategy promotes management that will increase insect populations and seed availability (as food for birds) it is also likely to be effective at helping declining insect and arable plant populations, although some of these have their own specific requirements.

¹
Corn flower.

'The Big Three' for farmland birds

A safe nesting site

Birds need a nest site that is protected from disturbance by farming activities and the risk of predation. For tree sparrows this is a dense hedgerow or a clump of trees. For linnets, it is usually a patch of gorse scrub. For grey partridges and yellowhammers, it is dense tussocky grass margins along field boundaries (particularly next to a hedge or some scrub). Some species such as skylarks, lapwings and corn buntings nest out in the middle of open fields and require fields that are not heavily grazed or mown during the nesting period. For skylarks, the main nesting period is late April until mid July; for lapwings it is late March until mid May; for corn buntings it is late May until early August.

Summer food

Although many farmland birds are seed-eaters, most species need a good supply of insects and other invertebrates to provide a high protein diet for their chicks. A wide range of invertebrates are eaten, but larger prey

items such as caterpillars, sawfly larvae and beetles are particularly valuable food for chicks when they are in the nest.

Winter food and shelter

The winter food of farmland birds usually includes a variety of seeds. There is often a particular shortage in late winter once the previous summer's seed production has been used up. Different species require different types of seeds, with finches usually eating small seeds such as brassicas while buntings and sparrows prefer grain. In late winter there is usually also a shortage of shelter as the previous year's vegetation cover has died back. This makes some species such as grey partridge particularly vulnerable to predation so habitats that provide some shelter such as game crops and winter stubbles can be extremely valuable.

Providing the 'Big Three' gives farmland bird populations the best chance of survival, helping them to cope with other sources of mortality such as predation and adverse weather.

'A Big Three' for bumblebees and other bees

Bumblebees are key pollinators of legumes and soft fruits, with six common species providing the bulk of this service, although many growers supplement with commercial (non-native) bumblebee nests. Bumblebees and honeybees boost yields of crops such as oil-seed rape, and as such have considerable economic, environmental and aesthetic values. All bees have three main requirements:

Nest Site

Bumblebee nests are located usually underground, often in the old nest of a mouse or vole or, above ground, in tussocky grass. Away from gardens, nest densities are highest along fence lines, hedgerows and woodland edge.

Food Supply throughout the summer

Bumblebees require a continuous supply of nectar (as sugar-rich fuel) and pollen (rich in protein for developing larvae) throughout the spring and summer. Good sources

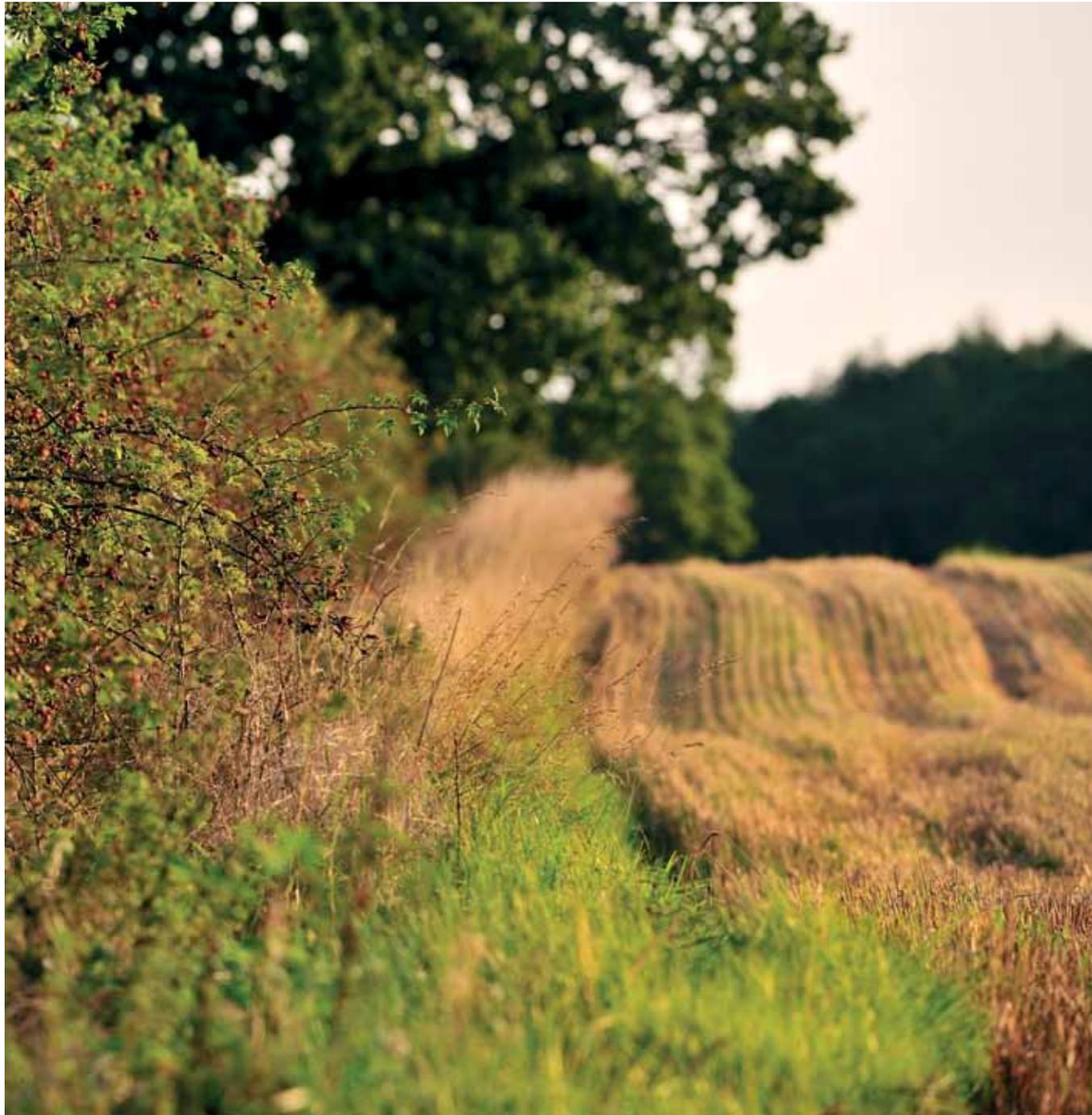
of food in spring encourage queens to found nests nearby. Flowering crops can provide a rich source of food, but for too short a period to sustain nests and populations. Having a variety of perennial wildflowers (particularly clovers and vetches) alongside crops provides a sustained supply of nectar and high-protein pollen throughout the summer.

Hibernation site for Queens

Survival of the bumblebee population from one year to the next is dependent on the recruitment of mated queens and their survival over the winter so that they can establish new nests in the spring. Hibernation sites are often underground or among tree roots or dead wood in a cool, shady location. Patches of woodland and scrub may provide important hibernation sites in arable farmland.

- 2 Linnet.
- 3 Yellowhammer.
- 4 Great yellow bumblebee.
- 5 Strip of red clover.





Creating and managing conservation habitats

Managing specific areas of the farm for wildlife is probably the most popular conservation strategy among farmers and a natural extension of the concept of set-aside.

Managing arable habitats for wildlife can often be combined with business objectives. Many management options are supported by an annual payment under the Scottish Rural Development Programme. Additionally, field margins, wet areas and other awkward corners with lower productivity may advantageously be managed as wildlife

habitats, although choosing the right location and careful management are the key to ensuring that the maximum benefit is delivered at each location.

Knowing what wildlife is present on and around the farm is important to choose appropriate management, particularly if species with specialised requirements are present. Ongoing schemes such as the RSPB Volunteer and Farmer Alliance provide the ideal opportunity to get a detailed review of the birdlife on a farm. Less formally, speaking to local birdwatchers or wildlife enthusiasts can be a useful source of information and such people often appreciate the opportunity to visit new areas.

Indicative financial margins for a range of arable habitat creation options, based on 2010 prices and payment rates

	Grass margins	Grass margins with 5% native wild flowers	Wild bird cover 1 year	Wild bird cover 2 year	Pollen and nectar mix	Native wild flower meadow
No. years of management	5	5	1	2	3	5
SRDP payment rate	–	474	391	391	–	360
Annualised seed cost	15	30	60	65	30	150
Gross margin	-15	444	331	326	-30	210
Annualised establishment and management costs (contractor's charges)	27	27	100	50	55	60
Enterprise margin	-42	417	231	276	-85	150

¹
Hedgerow and field margin, Gallowhill, Tayside and Clackmannanshire Area.

Grass margins

Grass margins along the edge of arable fields provide nesting cover for birds such as grey partridge and yellowhammer, an insect-rich summer foraging habitat for many farmland birds and a suitable nesting habitat for bumblebees, thus helping to deliver the ‘Big Three’. They can also form useful buffer strips, protecting watercourses and other natural habitats from soil erosion, fertiliser run-off and spray drift.

Width of the margins

The width of grass margins is often determined by practical considerations such as the width of the drill used to establish the seed mix, but margins of between 1.5-6m in width will deliver significant wildlife benefits as different species will have different requirements. For instance 6m wide margins will provide good foraging habitat for barn owl whilst grey partridges will tend to nest in narrower strips (2m) but will benefit from adjacent conservation headlands or wild bird covers for chick food. Combining grass margins with the management of adjacent hedgerows will provide an ideal nesting habitat for grey partridges and yellowhammers, which like to nest on the ground in the shelter of a hedge. Game & Wildlife Conservation Trust (GWCT) research has shown that 4.3-6.9 km of good field margin nesting cover is required per square kilometre of farmland to halt the decline and help recover populations of Grey Partridges.

Sowing the mix

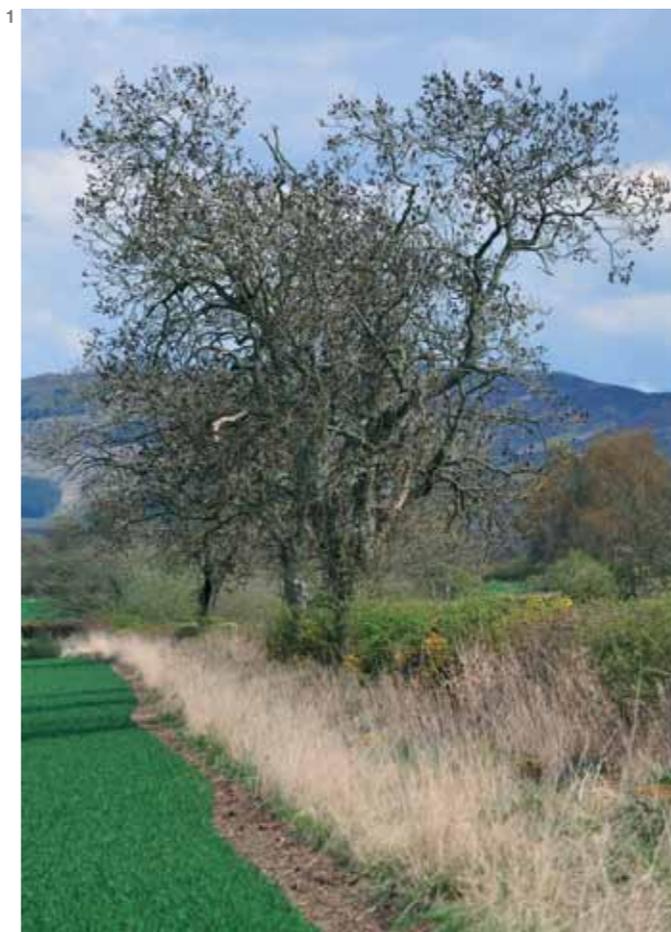
Many set-aside grass margins were established through natural regeneration, but there are clear benefits to wildlife if a suitable seed mix is sown in spring or autumn into a fine, firm seed-bed. The mix should contain a variety of grass species, including tussock-forming species such as cocksfoot and timothy to maximise structural diversity in the sward. The value of grass margins for nectar feeding insects and the wildlife that feeds on them is greatly enhanced if wild flowers are included in the sward. This could be the simple addition of an agricultural clover cultivar which will flower for up to four years and support the longer-tongued bumblebees. However, a greater flowering continuity will be achieved if a mixture of species is used, that will support a wider range of bumblebee species, which then pollinate a wider range of crops and wildflowers. The wild flower component is also likely to persist for longer if native wild flowers are used, for example a variety of robust and vigorous species such as knapweed, yarrow and oxeye daisy.

Cutting/grazing regime

Grass margins should be left undisturbed during the summer. Although cutting or grazing after harvest reduces the structural diversity of the sward in the short term it does help to maintain structure in the long-term and prevents margins from becoming overgrown. The ideal management of grass margins for conservation is similar to that for hedgerows – cutting around one-third of the margins on the farm on a three year rotation. For 6m margins, annual cutting (prior to nesting) of 3m nearest the crop encourages a more diverse grass structure. Margins should not be cut shorter than 10cm to ensure that the grass tussocks continue to provide an overwintering site for insects.

Enriching existing margins

Existing grass margins can be enriched by sowing one or more nectar and pollen-bearing species, with recommended mixes appropriate for different situations. This should be carried out when there is plenty of moisture in the soil – clover must be sown in the spring but natural wild flowers may also be sown in autumn. The existing grass cover should be cut as short as possible before sowing and a direct drill should be used to ensure that the seed makes contact with the soil. The grass cover should be cut again after a couple of weeks to reduce competition with the germinating wild flowers.



Examples of suitable seed mix for grass margins

Grasses	% by weight
Cocksfoot	35
Cocksfoot	30
Timothy	25
Timothy	30
Creeping red fescue	25
Creeping red fescue	20
Perennial ryegrass	15
Smooth stalked meadow grass	10
Red clover	10

- Recommended seeding rate: 20-25 kg/ha
 - Typical cost of seed: £50-75/ha
- Optional wild flower component:
- Short-term margins oxeye daisy, yarrow, bush vetch
 - Long-term margins red clover, common knapweed, tufted vetch or meadow vetchling(1-2 kg/ha)
 - Typical cost of seed: £60-£150/ha

Key points

- A network of at least 4km of 2-6m wide grass margin per 100 hectares provides the best cover
- Grass margins adjacent to hedgerows and watercourses and adjacent to conservation headlands in the crop are particularly beneficial.
- Sow a diverse mix of grass species and include some nectar and pollen-bearing plants such as red clover, tufted vetch, knapweed and yarrow.
- Cut one-third of the grass margins on the farm each year after harvest, following a three year rotation, or lightly graze after harvest.

1
Field margin and hedgerow trees, Gallowhill, Tayside and Clackmannanshire Area.



2

Grass Margins – Andet Farm, Methlick, Aberdeenshire

At Andet Farm, Neil Gray has had grass margins through the Countryside Premium Scheme since 2000. The rules of this scheme prevented cutting or grazing of the margins and the vegetation is now very tall and tussocky. This provides excellent nesting and winter cover for partridges and yellowhammers, but the tall grasses tend to smother out other plants, meaning that the diversity of plants and associated insects may not be as high as it could have been had the management been different. Most of these margins are likely to be transferred into the Land Manager's Options scheme in due course, which will allow them to be cut after harvest every on a 2-3 year rotation.



3

Managing Grass Margins – Cairnhill Farm, Turriff, Aberdeenshire

At Cairnhill Farm, James Norrie mows his grass margins after harvest each year. This helps maintain more botanical diversity and improves access for foraging birds. However, it does reduce the amount of cover available, particularly nesting cover for grey partridges the following spring, as they tend to nest in the residual tussocks of the previous year's growth. Some of the margins include wildflowers such as knapweed and oxeye daisy which enhances the supply of nectar and pollen for insects.

2

Grass margin at Andet Farm.

3

Grass margin at Cairnhill Farm.

Wild bird cover

Wild bird cover (also known as unharvested crops or game cover) provides a valuable source of seed food for birds over the winter and can also provide shelter from predators at a time when there is very limited cover available from crops and grassland. The addition of a small proportion of nectar and pollen-bearing flowers provides a good source of food for bees. Additionally, when sown as a biannual mix wild bird cover can provide excellent chick foraging habitat in its second year of growth.



Wild bird cover – Cowbog Farm, Morebattle, Roxburghshire

Robert Wilson has established 10ha of wild bird cover across 200ha of farmland, mostly making use of awkward field corners that are difficult to cultivate. The plots are sown with a two-year mix of oats, triticale and kale. Over winter, the plots attract huge flocks of chaffinches, goldfinches, reed buntings, yellowhammers, tree sparrows and linnets. In addition, barn owls breed on the farm and are often seen hunting over the wild bird cover plots. Bumblebees, damselflies and several butterfly species use the plots throughout the summer months and grey partridge numbers have increased dramatically in recent years, in large part due to the areas of wild bird cover and grass margins that have been provided.

- 1 Unharvested crop.
- 2 Goldfinch.
- 3 Two year wild bird cover at Cowbog Farm.

Where to establish a wild bird cover?

Flocks of finches, tree sparrows and buntings are more likely to feed in wild bird cover if there are safe places of retreat for when they are disturbed. Establishing crops next to hedges, trees, shrubs and overhead wires is therefore likely to encourage their use by these birds. However, sites next to dense woodland or forestry are less suitable as they are avoided by many open-country farmland species.

Around 1-2ha of well-established wild bird cover per 100ha of farmland provides good cover for mobile flocks of small birds such as finches and buntings. GWCT research demonstrates that 3% of the arable habitat needs to be insect-rich brood rearing cover (wild bird cover, unharvested crops or conservation headlands) to help halt grey partridge decline and 5% for population recovery to the Biodiversity Action Plan targets. Species such as grey partridges are territorial in late winter and benefit most if small plots or strips of wild bird cover (around 0.25 ha each) are scattered throughout the area. However, rabbit and deer grazing can have a disproportionate effect on very narrow strips (<10 metres) and these should be avoided.

Mixes

Wild bird cover is established in the spring using either a one- or two-year seed mix. One-year mixes are usually cereal-based while two-year mixes combine cereals with a Brassica (usually kale) to provide a source of seeds in the second year.

Two-year mixes often provide better cover from predators, but kale can be difficult to establish, requiring high fertility for good growth. If kale growth is poor in the first year, there is likely to be little seed availability during the second year and grass weeds can become established. In these circumstances, a one-year mix would provide equal benefit. One-year mixes are also preferred where they are intended to help grain-eaters such as the corn bunting, as the cereal component usually disappears during the second year of two-year mixes. Outside corn

bunting areas, an alternative to failing kale is to sow a mix of quick growing crops like mustard, fodder radish, forage rape or stubble turnips that will patch failed spring sown covers. Mustard and fodder radish can be used as a 'rescue crop' but are not winter hardy and will not provide a cover throughout the winter.

Spring triticale, quinoa, linseed and spring tic beans are valuable sources of seeds and are suitable to Scottish conditions.

Having separate blocks of two-year wild bird cover with alternating sowing years ensures that a variety of different seed types are available each year.

Establishment

Cultivation should aim to provide a firm, fine seed bed prior to sowing. The smaller seeds should not be sown too deep, so many people prefer to broadcast the smaller seeds and drill the cereal component. A low rate of fertiliser (30kg N/ha, up to 90kg N/ha for Kale) may be applied to aid establishment but is not always necessary and should be avoided if there is already high fertility.

Key points

- Aim to have at least 1-2ha of wild bird cover per 100 hectares of farmland, ideally in 2-4 separate blocks or strips.
- Locate wild bird cover adjacent to a hedge, scattered scrub or trees or next to an overhead wire to provide a place of retreat for small birds.
- Avoid sites next to dense woodland or forest.
- Sow a suitable one or two year crop mix, but avoid two year mixes if kale does not establish well in you area.
- Sow different blocks of two-year mixes in alternate years to ensure that a wide range of seeds are available each year.

Examples of seed mixtures for Wild Bird Cover with added nectar source for bumblebees

More suggestions are provided in RSPB 'Farming and Crofting for birds in Scotland' leaflets or on the GWCT website (www.gwct.org.uk). Cost of mixtures can range from £50-£130 per ha, with two year mixes generally more expensive than one year mixes.

Two year mix	Kg/ha	One year mix	Kg/ha
Oats	20.0	Oats	15.0
Barley	20.0	Barley	35.0
Kale, merlin	1.0	Triticale	20.0
Kale, maris kestrel	1.0	Spring rape	1.0
Kale, keeper	1.0	Mustard	1.0
Quinoa	1.0	Linseed	1.0
Spring rape	0.5	Clover red	0.5
Mustard	0.5		
Red clover	1.0		

4
Grain crop for small birds, Balliefurth Farm, Grantown on Spey.



Grassland and wild flower habitats

Many areas of permanent set-aside were sown with grass and managed with low inputs and limited disturbance through cutting. Such areas of setaside have often been retained where the ground is wet or steep or alongside an environmentally sensitive habitat such as a watercourse.

Continuing to manage these areas in a low-intensity manner is beneficial to insects and the species that feed on them and to ground nesting birds such as curlews, skylarks and corn buntings. Management of grassland habitats is also important for arable wildlife in the mixed farming systems that predominate in some parts of Scotland.

Wild flowers can be incorporated into seed mixes for long-term grass margins, but dedicated wild flower habitats can provide an even richer source of nectar and pollen for insects, especially under sympathetic cutting and/or grazing management. These insects in turn provide a rich source of summer food for farmland birds.



1

2



Clover Leys – Cairnhill Farm, Turriff, Aberdeenshire

Organic farmers such as James Norrie at Cairnhill in Aberdeenshire frequently make use of short-term clover leys as part of the arable rotation, as they fix nitrogen and build soil fertility. Flowering clover also provides an abundance of nectar and pollen for insects on the farm. Clover leys are by no means limited to organic farming systems and they may be worth considering by conventional arable (and particularly mixed) farmers for their agronomic and environmental benefits.

Clover leys

A 1-2 year clover ley can produce a similar yield to a conventional grass silage crop but with a saving of £150-£200/ha in nitrogen fertiliser costs. Furthermore they can reduce the nitrogen requirement of the following crop by 20-40 kg/ha (a saving of £10-£20 per ha at current prices). The greatest savings are achieved if it is possible to graze the clover within two months prior to ploughing as the dung produced releases the nitrogen in a more readily available form.

The key to delivering wildlife benefits from clover leys is to allow the clover to fully flower before cutting, otherwise there will be no nectar or pollen available for bumblebees and other insects. Although clover silage is usually cut later than conventional grass silage, delaying cutting until after full flowering may result in a slight decline in quality, but this is not as severe as that which affects late cut grass silage. As full flowering may not occur until July, clover silage also has the potential to provide a safe nesting site for birds such as corn buntings and skylarks.

1
Species-rich grassland with
red clover and bird's foot trefoil,
Woodend, Little Glenshee.
2
Great yellow bumblebee.



3

Corn Bunting Management – Cornceres Farm, Anstruther, Fife/ Harvieston Farm, Catterline, Kincardineshire

Corn buntings are the most seriously threatened of all the farmland birds in Scotland with only 800 pairs remaining in the eastern lowlands and the Uists. As a ground-nesting species, in eastern Scotland it shows a preference for dense grassland rather than more open cereal crops for first nesting attempts during early June. However, due to its habit of nesting later in the summer than most birds it is particularly vulnerable to silage cutting, which can destroy most first nesting attempts.

Andrew Peddie at Cornceres farm in Fife and David Argo at Harvieston in Kincardineshire have both worked with the RSPB for several years to manage grass set-aside fields as nesting habitat for Corn buntings. The fields are not mown until August and this usually results in fewer first nesting attempts being destroyed. Although silage quality is reduced by late cutting, this is compensated for by the agri-environment payments that are received.



4

Species-rich grassland

Creating species-rich grassland on a sterile seed bed has been the most widely used technique in Scotland, but requires careful establishment and ongoing management to be successful as it is intended as permanent recreation of a semi-natural habitat.

Where to establish species-rich grasslands?

Sites should be free of significant weed problems, particularly the common perennial weeds of grassland such as docks and thistles. The site should ideally be of relatively low fertility.

Mixes

The seed mix should include a variety of grasses and at least 15% native wildflowers, ideally of local origin. Some of the seed mixes that have been sown in the past have largely comprised annual wild flowers such as poppies and cornflowers. These produce a very colourful display in the first year but are outcompeted by grasses in subsequent years. It is therefore important that most of the wildflower seeds are of perennial species. These may be less spectacular visually but provide an ongoing nectar and pollen resource for years to come.

Prices may vary between £400-550/ha for mixes including cultivars or a high proportion of grass (above 90%), to more than £1500/ha for more diverse mixes of native grasses and wildflowers that will benefit a wider range of insects and may be more suitable to local conditions.

3
Corn bunting.

4
Wildflower meadow at Keltneyburn, Perthshire.

Cutting/grazing regime

Once established, species rich grassland should be cut in late summer or autumn, and the cuttings removed. Late cutting (after 15th August) is particularly important in areas where corn buntings are breeding. Grazing the aftermath with livestock during the winter can help to thicken the sward and reduce the dominance of unwelcome grasses (e.g. Yorkshire fog) and the risk of weeds such as thistles and ragwort becoming established. Alternatively, an appropriate grazing regime can be applied throughout the year. Light grazing in the summer can help maintain a patchy cover. Cattle are less selective than sheep and will help maintain different heights of vegetation while leaving plenty of flowering heads. They are suitable in areas that are not susceptible to poaching. Very light grazing in late spring is particularly important to avoid bird nests and early flowers to be destroyed. Livestock should be removed in winter and early spring if the risks of poaching are important. Supplementary feeding should be avoided as it may introduce foreign seeds and nutrients and encourage damages to the sward.

Example of species-rich grassland mix for bumblebees and butterflies

Local origin seed will establish better and is recommended wherever possible, although this may increase the cost considerably (£750/ha or more). Seed should be sown at a rate of at least 15kg/ha and preferably 20-25kg/ha.

Grasses

Strong creeping red fescue	35%
Smooth stalked meadow grass	31%
Crested dog's tail	15%
Meadow foxtail	4%

Wildflowers

Red clover	2%
Bird's foot trefoil	1%
Meadow buttercup	2%
Yarrow	1%
Common knapweed	1.55%
Lady's bedstraw	0.70%
Ribwort plantain	1.50%
Yellow rattle	0.50%
Tufted vetch	1.50%
Common sorrel	0.20%
White clover	1%
Meadow vetchling	0.05%
Self heal	2%

Nectar and Pollen mixes

Mixes

A simpler way of boosting the availability of nectar and pollen for insects such as bees and butterflies is to sow a mixture of at least three nectar rich legume species such as clovers, vetches and trefoils in a plot or strip within a field, ideally in a sheltered, sunny location. The mix may also contain fine grasses such as red fescue and common bent at a ration of 80% grasses: 20% legumes and should be sown at a rate of about 20kg/ha.

However, grass-free mixes are also commonly used, which provide much greater benefits for bees. This creates a temporary habitat that will last for three or four years before a new mix will need to be sown.

Cutting regime

The plot should be cut in late autumn (ideally removing the cuttings) although in south-east Scotland cutting part of the plot in mid-summer may help to prolong the flowering period. This type of management is rare in Scotland at present as it has not been supported by agri-environment schemes, but is employed as part of environmental programmes adopted by certain food retailers.

Ideally the aim would be to create 1-2ha of nectar and pollen rich habitat per 100ha of farmland, in individual plots of up to 0.5ha. This is similar to the recommended amount of wild bird cover.

Alternating the pollen and nectar mix and wild bird cover on the same plots of land every 3-4 years may help to maintain fertility and control the weed burden in wild bird cover.

Key points

Consider using a clover ley as a means of building fertility in the arable rotation and providing high quality forage for livestock.

- This can reduce the nitrogen requirement of the following crop by 20-40kg/ha.
- Cut these and other areas of grassland set aside as late as possible to protect groundnesting birds – ideally mid July or later.
- In areas with corn buntings, take expert advice to ensure effective targeting of late grass cutting. The requirement for the Rural Priority corn bunting option is to avoid cutting, grazing or rolling the grass between 1 May and 1 August.
- Aim to have 1-2ha of wild flower habitat per 100 hectares of farmland, ideally in plots of no more than 0.5ha.
- Choose sheltered, sunny locations for the plots – Sow a mix of 80% fine grasses and 20% legumes (clover, vetches, trefoil) at a rate of 20kg/ha, or a grassfree mix of legumes at 15-20kg/ha. If spring-sown, include at least one annual species to provide nectar and pollen in the first summer.
- Alternatively, sow a local origin mix of 85% fine grasses and 15% native wild meadow flowers to create a permanent wild flower habitat.
- Cut the plot in late summer or autumn and remove the cuttings.
- Temporary nectar and pollen mixes could be established in rotation with wild bird cover."



Enhancing the value of cropped areas for wildlife

While creating habitats alongside cropped areas is extremely beneficial to wildlife, the cropped area itself can deliver enhanced benefits for wildlife, through targeted use of fertilisers and pesticides but also by managing areas of stubbles and introducing fallows in the rotation.



1
Barley.
2
Seven spotted ladybird on barley ear.

Input efficiency

Making the most efficient use of crop inputs makes considerable economic sense, particularly as rising oil costs push up the price of fertiliser and other crop inputs. An integrated farming approach that combines measures such as varietal choice for disease resistance, minimum tillage and precision farming to optimise nutrient and crop protection inputs has the potential to deliver significant financial and environmental benefits.

Many of the environmental benefits of integrated farming relate to soil and water conservation but there are also specific benefits to farmland wildlife, particularly through measures that reduce nutrient and pesticide inputs.

The main value for wildlife of reduced crop inputs is likely to be an increase in plant diversity within the crop with associated benefits for rare arable plants, insects and seed-eating species, thus helping to provide both the summer and winter food elements of the 'Big Three' for farmland birds. Some of the plants that benefit may be considered to be weed species by farmers. Fortunately, many of the more desirable weeds for wildlife are the less competitive or more easily controlled species. It is therefore possible to consider management techniques that might allow some desirable weeds to flourish without encouraging the problem species.

Management options

Precision farming can help to optimise crop inputs and save money through a number of techniques such as:

- GPS Guidance systems to reduce overlaps in cultivation, sprays and fertiliser.
- Mapping variation in soils, crop growth and yield
- Variable application of sprays and fertiliser

The practicality of investing in precision farming technology will depend on the size of the farm and the amount of variability in soils and crop yields on the farm. Recent research suggests that precision farming methods could deliver net benefits of £6-19/ha for arable farms of 300-750ha in area, with the largest farms getting the greatest benefit⁴. The cost of investing in the technology to deliver this net benefit ranged from £14-£36/ha. Manual-steer GPS guidance systems can deliver savings for an initial capital investment of £1000-4000 and are likely to be the most cost effective introduction to precision farming for smaller arable farms. More accurate autosteer systems may cost £15-20,000 or more and will only be cost effective for very large farms.

Improving the use of herbicides

A more straightforward method of increasing desirable weeds is simply to reduce herbicide use across the whole field (or part of a field), if it is possible to do this without significant economic or agronomic problems. In organic farms this is done as a matter of course, but with care it can also be carried out on conventional farms.

Research on winter wheat from the SAFFIE project (Sustainable Arable Farming for an Improved Environment) found that on light soils with a low weed burden (those without the undesirable species mentioned in the table), it was possible to increase desirable weeds alone by applying herbicide only in spring, often without yield loss. SAC research has shown that avoiding autumn weed control is easiest in later-sown winter crops⁵.

Spring cereals often suffer negligible yield loss even in the absence of any herbicide application at all. SAC trials suggest that 2.5-3.0% yield loss is typical in untreated spring barley⁶. At recent low grain prices this cost is offset by the savings in herbicide, resulting in a financially neutral outcome. However, the primary reason for herbicide use in spring crops is to prevent a long-term build-up of weed populations and to avoid excessive weed growth that interferes with harvesting, while those with high value grain crops (e.g. for seed or malting) will want to avoid weed seed contamination.

Implementation of reduced herbicide management will therefore be site-specific.

In general this type of management should not be carried out continuously on any one field to prevent the development of an unacceptable weed burden in the long term. Moving the unsprayed area to a different location every one or two years and resuming conventional management on the original location can help to avoid this problem, as can following a traditional arable-grass rotation.

Some farmers may be wary of risking reduced herbicide management, but for spring crops there is a payment of £96/ha available under the Land Manager's Options scheme if this type of management is combined with the retention of stubbles until the end of February, which makes the option much more financially attractive. It is also possible to implement this type of management on a strip at the edge of the field (conservation headland) or on an area within a field (for example if rare arable plants such as cornflower are present). For conservation headlands, the aim is to avoid using broadleaf herbicides and insecticides and financial support is available through Land Manager's Options. Graminicides and fungicides typically have a low impact on farmland wildlife, so there is no need to avoid using these products if they are required. Reducing fertiliser use on conservation headlands can also reduce problems from aggressive weeds such as cleavers.

When to envisage herbicide reduction?

	Characteristics of the site	
Soil	Light	Heavy
Weeds present	Low growing broad leaved and meadow-grass species	Problematic weeds (e.g. couch, black-grass, cleavers)
Crop	Grain is grown for feed	Grain is grown for malting or seed production
Suitability for herbicide reduction	Suitable	Should be avoided

'Desirable Weeds' Source: SAFFIE Project

Pictures and information on the weeds can be found on HGCA online Encyclopaedia of Arable Weeds: www.hgca.com/awe

Undesirable	Desirable	Very desirable
Black-grass	Fumitory	Annual meadow-grass
Broad-leaved dock	Groundsel	Black-bindweed
Brome grasses	Mayweeds	Charlock
Cleavers	Mouse-ear	Chickweed
Couch	Pansies	Fat-hen
Creeping thistle	Sow-thistles	Knotgrass
Crop volunteers		Redshank
Wild-oats		Wild radish

Key points

- Look at the potential for precision farming to deliver cost savings and environmental benefits on the farm.
- In winter cereals on light soil with a low weed burden, consider using selective herbicides and spraying in spring only.
- In spring cereals on light soil with a low weed burden, consider reducing or avoiding herbicide use on a rotational basis.
- Consider having unsprayed or selectively sprayed (no broadleaf herbicides or insecticides) conservation headlands (at least 6 metres wide) along the margins of arable fields.

Integrated and precision farming – Gilston Mains, Leven, Fife

Edward Baxter is a TIBRE arable group farmer and crops over 800ha at Gilston Mains (a LEAF demonstration farm) and contracted ground. Varietal choice, agronomic crop walking, low-dose spraying equipment, crop rotation and yield monitoring form the basis of the integrated farm management system that has been implemented here for over twenty years. Minimum tillage is used when establishing some crops and for fields that are ploughed, low ground-pressure tyres and on-land ploughs are used to minimise soil compaction. The farm has recently invested in high precision GPS auto-steer guidance systems for two tractors which will allow more accurate cultivation, drilling and spraying. Research suggests that this type of system delivers savings of over £20/ha in fuel, time and inputs through reduced overlaps, against a cost of around £12/ha for an 800ha farm. Lower cost guidance systems deliver smaller savings but are more cost effective for farms of less than 500ha.



Conservation Headlands – Meadowend Farm, Clackmannanshire

At Meadowend, the Turnbills maintain unsprayed conservation headlands along the margins of some of their arable fields. Due to the width of the sprayer boom that they use relative to the size of the field, they are often left with a narrow strip of crop at the edge of the field that is left unsprayed. This makes practical sense as well as enhancing the habitat for farmland birds, and is a very low cost solution. Some of the unsprayed headlands are also left unharvested to provide a simple form of wild bird cover

1
Redshank.

2
Unharvested conservation headlands at Meadowend Farm.

Fallows and stubbles

Stubble management

Stubbles have traditionally been one of the most important sources of seed food and shelter for farmland birds over the winter. Spilt grain and weed seeds among the stubble can attract large flocks of finches, larks and buntings. However, the advent of winter cropping has reduced the amount of stubble available and better weed control has reduced the number of seeds available within the remaining stubbles. As stubbles are gradually ploughed throughout the winter, those remaining until late winter or early spring are particularly valuable at a time when seed resources for birds are scarcest.

Stubbles for wildlife should ideally be left unploughed as late as possible (end of February). To deliver widespread benefits for seed-eating birds, 10-20% of arable land should be left as late ploughed stubbles as research has shown that the skylark population declines if the proportion of overwintered stubble in the landscape drops below 10%. The value of stubbles for wildlife is dependent on them providing a rich source of seeds, so to maximise benefits, the retention of late ploughed stubbles should ideally follow the kind of reduced herbicide management described earlier in the input efficiency section.

Fallow Management

One of the most valuable forms of set-aside for wildlife was rotational set-aside where naturally regenerated stubble was left fallow over the following growing season. As well as providing seed-rich stubble well into the spring, the patchy, diverse vegetation that regenerates provides an insect rich habitat during the summer and an undisturbed breeding area for ground nesting birds and mammals such as the brown hare. The benefits of fallows for invertebrates largely depend on seed bank diversity. First year fallows usually provide little for bumblebees but leaving fallows for a second year allows the flowering of useful perennial or biennial flowers. Fallows can also have an agronomic benefit, allowing soil fertility to recover and soil structure to improve following continuous cultivation.

Management of fallows for wildlife should aim to delay cultivation or mowing of the vegetation until at least late July to protect ground-nesting birds. Spraying can also be delayed until this time if the vegetation is largely broad-leaved weeds and crop volunteers. However, if problematic grass weeds are present, earlier spraying may be necessary to achieve control.



1
Field corner left set-aside.

Example of gross margins for spring barley at different grain prices, based on figures from The Farm Management Handbook 2009/10 (SAC)

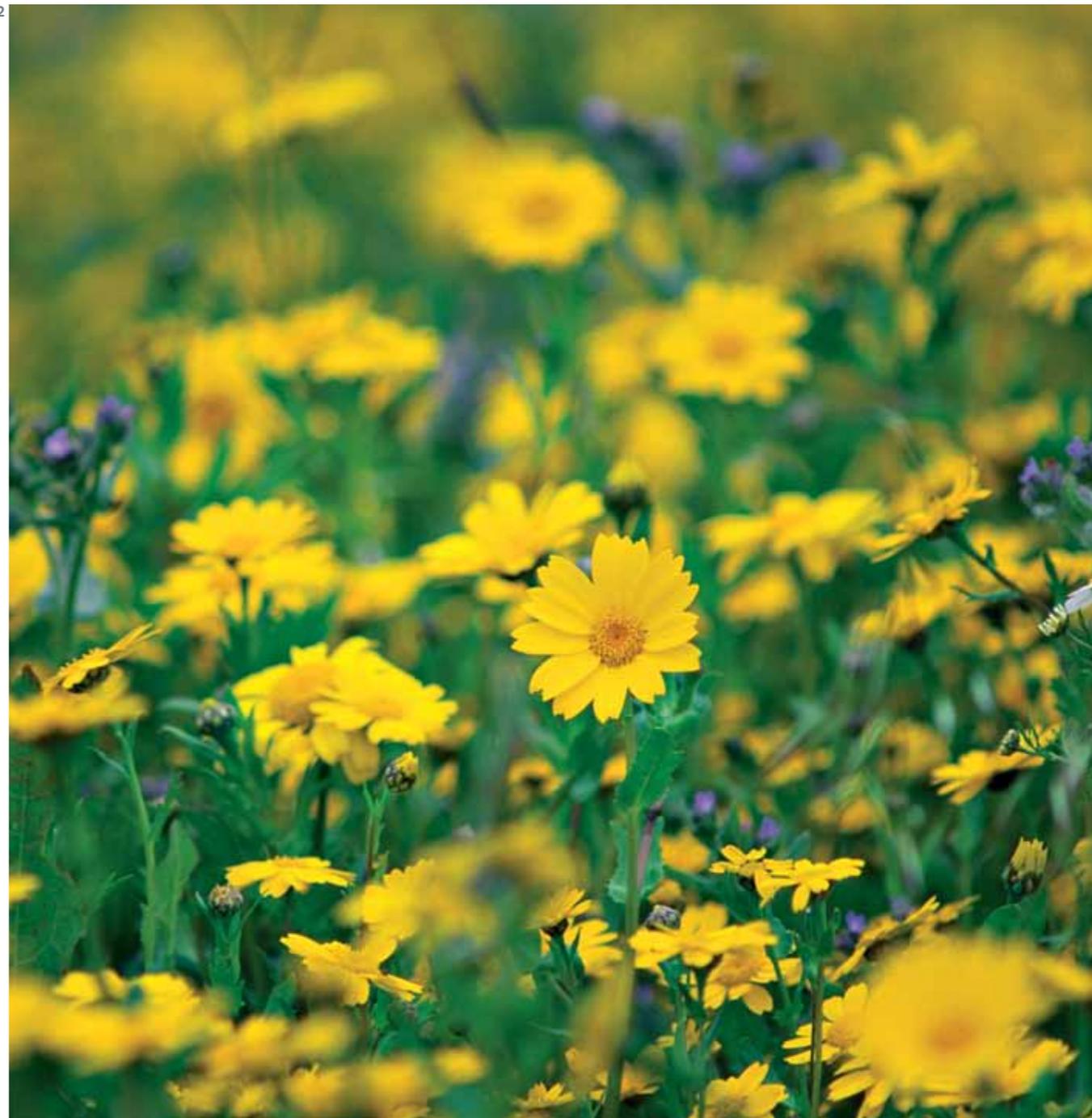
	Spring barley @ £75/t	Spring barley @ £100/t	Spring barley @ £125/t
Gross margin	£252	£389	£527
Contractor's rates (ploughing, sowing, fertilising, spraying, combining and baling)	£220	£220	£220
Fuel costs	£32	£32	£32
Typical drying costs	£20	£20	£20
Enterprise margin	-£20	£117	£255

Key points

- Aim to retain 10-20 ha of stubbles per 100ha of land until the end of February.
- Combine stubble retention with reduced herbicide inputs on the preceding crop to maximise the value to seed-eating birds.
 - Maintain some stubbles as rotational fallow if economics and practicality of farm management allow.
 - Delay cutting, cultivating and spraying of fallow stubbles as late as possible, and ideally until at least late July.

2
Corn marigolds.

2



Useful resources

Further advice is available from the following organisations, many of which provide technical and advisory notes that are available online or as printed and CD copies.

- Bumblebee Conservation Trust: www.bumblebeeconservation.org.uk
- Farmwildlife Website: www.farmwildlife.info
- Game & Wildlife Conservation Trust: www.gwct.org.uk
- RSPB Scotland – Farming and crofting for birds in Scotland advice notes: www.rspb.org.uk
- Plantlife – The Arable Plants Website: www.arableplants.org.uk
- HGCA online encyclopaedia of arable weeds: www.hgca.com/awe
- SAC Technical Notes: <http://www.sac.ac.uk/publications/technicalnotes/>
- SNH TIBRE Arable Handbook: <http://www.snh.org.uk/publications/on-line/heritagemanagement/tibre/>
- HGCA precision farming cost-benefit calculator: www.hgca.com/beprecise
- The Voluntary Initiative – Promoting responsible pesticide use: <http://www.voluntaryinitiative.org.uk/>

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- 1 POSTnote 348 Insect Pollination. Parliamentary Office of Science and Technology, January 2010
- 2 Pers. Comm. Dr R Dawson, Bumble Bee Conservation Trust, 2010
- 3 <http://www.rspb.org.uk/ourwork/farming/advice/conservation/big3.asp>
- 4 HGCA Research Review 71: An up-to-date cost/benefit analysis of precision farming techniques to guide growers of cereals and oilseeds, 2009
- 5 SAC Technical Note 540: Winter Wheat & Barley: The Integrated Management Of Weeds, 2003
- 6 SAC Technical Note 596: Spring Barley Weed Control, 2007

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Front cover image:

Corn cockle, corn flower, corn marigolds
and poppies growing at the edge of a
field of oats, Bankfoot.