

Experiment 3. Assessing the integrated effects of crop and margin management

The primary objective was to enhance farmland biodiversity by integrating novel habitat management approaches, in the crop and non-cropped margins, to develop more sustainable farming. Improved understanding of these interactions will lead to increases in invertebrate and weed seed abundance, and their availability, will be of particular benefit to farmland birds.

Materials and methods

Farm Sites

There were 26 sites located in Scotland, Lincolnshire, East Anglia and Herefordshire, mainly on clay soils

Treatments

Each farm provided 4 areas (fields or sub-divisions of fields) each greater than 5 ha. The treatments are listed below. Treatments were done during the three crop years 2003/2004, 2004/2005 and 2005/2006. The four areas at each farm were grouped as a single block or spatially separated.

| | Field treatment | Margins |
|---|---|---------|
| A | Conventional field centres | No |
| B | Field centres when in cereals to contain 2/ha 'undrilled patches' | yes |
| C | Conventional field centres | yes |
| D | Field centres when in cereals to contain 2/ha 'undrilled patches' | No |

Within field treatment

Each farm aimed to drill winter wheat crops in the rotation in 2 out of 3 years. All wheat crops were drilled with the local farm drill, where possible using the same variety and seed rate in all 4 treatments. Treatments A and C were drilled conventionally on the farmer's normal row spacing and treatments B and D were drilled as the conventional but leaving 2 'undrilled patches' per hectare. In the break crop year, break crops were, as far as possible, the same in all fields. Inputs and varieties could vary between break crop fields

Creation of undrilled patches

The field was drilled using a conventional seed drill at the normal seed rate and row width. During drilling the drill was turned off or lifted up during travel to leave an unsown area. The table below indicates what distance the drill was lifted for, to create a patch of the correct area

| Drill width (m) | Patch length (m) | |
|-----------------|------------------|--|
| 3 | 5.3 to 8 | Each patch was aimed to be consistently 16-24m ² in area. |
| 4 | 4 to 6 | |
| 6 | 3 to 4 | |
| 8 | 3 | |

The layout of the patches in the field was not critical, but host farmers were asked not to create the patches on tramlines. Patches were randomly or neatly spaced and at least 24m from the edge of the field.

If the patches were not made at drilling they were sprayed out between full emergence of the crop (approx 6 weeks after drilling, when rows are visible) and prior to GS 13 (3 leaves) using glyphosate at 360g a.s./l.

Margin seed mixtures

The margins were sown with two seed mixtures. The seed mixtures were identical at all sites and contained a mixture of fine or tussock grasses mixed with broad-leaf/forbs species (see below). The seed mixtures were similar to those used in Experiment 2. The seed was purchased from a central source and sown using farm implements local to the site at a seed rate of 35 kg/ha. The margins were sown by the host farmers during spring 2003.

Details of seed mixtures used

a) Tussock grass plus broad-leaves/forbs

| Species | Common Name | % (by wt.) |
|--|-------------------|------------|
| <u>Grasses</u> | | |
| <i>Alopecurus pratensis</i> | Meadow Foxtail | 4.0 |
| <i>Dactylis glomerata</i> | Cocksfoot | 16.0 |
| <i>Deschampsia cespitosa</i> | Wavy Hair-Grass | 8.0 |
| <i>Festuca pratensis</i> | Meadow Fescue | 20.0 |
| <i>Festuca rubra</i> spp. <i>rubra</i> | Red Fescue | 20.0 |
| <i>Holcus lanatus</i> | Yorkshire Fog | 4.0 |
| <i>Phleum pratense</i> | Timothy | 8.0 |
| <u>broad-leaves/forbs</u> | | |
| <i>Achillea millefolium</i> | Yarrow | 1.2 |
| <i>Centaurea nigra</i> | Common Knapweed | 2.7 |
| <i>Centaurea scabiosa</i> | Greater Knapweed | 1.6 |
| <i>Daucus carota</i> | Wild Carrot | 2.4 |
| <i>Dipsacus fullonum</i> | Wild Teasel | 1.6 |
| <i>Galium mollugo</i> | Hedge Bedstraw | 2.0 |
| <i>Geranium pratense</i> | Meadow Cranesbill | 1.0 |
| <i>Lathyrus pratensis</i> | Meadow Vetchling | 1.0 |
| <i>Leucanthemum vulgare</i> | Oxeye Daisy | 2.0 |
| <i>Silene dioica</i> | Red Campion | 3.0 |
| <i>Vicia cracca</i> | Tufted Vetch | 1.5 |

c) Fine leaved grass plus broad-leaves/forbs

| Species | Common Name | % (by wt.) |
|--|------------------|------------|
| <u>Grasses</u> | | |
| <i>Agrostis capillaris</i> | Common Bent | 5.0 |
| <i>Cynosurus cristatus</i> | Crested Dogstail | 35.0 |
| <i>Festuca rubra</i> ssp. <i>commutata</i> | Red Fescue | 15.0 |
| <i>Festuca rubra</i> ssp. <i>juncea</i> | Red Fescue | 25.0 |
| <u>Broad-leaves/Forbs</u> | | |
| <i>Achillea millefolium</i> | Yarrow | 0.5 |
| <i>Centaurea nigra</i> | Common Knapweed | 1.2 |
| <i>Daucus carota</i> | Wild Carrot | 1.0 |
| <i>Galium verum</i> | Lady's Bedstraw | 1.4 |

| | | |
|-----------------------------|-------------------|-----|
| <i>Geranium pratense</i> | Meadow Cranesbill | 0.6 |
| <i>Knautia arvensis</i> | Field Scabious | 1.2 |
| <i>Leontodon hispidus</i> | Rough Hawkbit | 1.0 |
| <i>Leucanthemum vulgare</i> | Oxeye Daisy | 1.4 |
| <i>Lotus corniculatus</i> | Birdsfoot Trefoil | 0.5 |
| <i>Malva moschata</i> | Musk Mallow | 1.4 |
| <i>Plantago lanceolata</i> | Ribwort Plantain | 1.0 |
| <i>Primula veris</i> | Cowslip | 1.1 |
| <i>Prunella vulgaris</i> | Selfheal | 1.0 |
| <i>Ranunculus acris</i> | Meadow Buttercup | 3.3 |
| <i>Rhinanthus minor</i> | Yellow Rattle | 1.0 |
| <i>Rumex acetosa</i> | Common Sorrel | 1.0 |
| <i>Vicia cracca</i> | Tufted Vetch | 1.4 |

Management

During the establishment year the host farmer was encourage to mow the margins to control volunteer crops and annual weeds. All margins were mown in spring 2004. Results from Experiment 2 lead to the selection of scarification as the chosen treatment for the margins. Scarification is achieved by the same methods used in experiment 2. A power harrow was used set at a suitable depth to cultivate the top 2.5 cm of the soil, with the aim of creating 60% soil disturbance. Scarification was done in early spring when the ground was fit to travel. In late winter 2004 host farmers and farm managers attended a workshop where the correct method of scarification was demonstrated.

In-field crop management

Crops in all treatments were managed to the ICM standard following guidelines in "Arable cropping and the environment – a guide", HGCA/DEFRA 2002.

Undrilled patches

Undrilled patches received the sprays applied to the field. At the end of the season there was the option to spray out bad weed infestations with glyphosate.

Space between hedge and crop or margin and crop

Crops were drilled sensibly close to the margin or hedge base vegetation. This narrow strip between crop and margin/basal vegetation was left untreated.

Margins

During the establishment year (2003) margins were mown (7.5-15cm) to prevent colonisation from arable crop volunteers and weeds such as brome, black-grass or cleavers. Typically this required 2-3 cuts between May and September. Margins were not to be used as tracks during the experimental period and remained unsprayed.

During the treatment years (2004-2006), the selected treatment was scarification. A power harrow was used to scarify this treatment. The implement was set to cultivate the top 2.5 cm of the margin sward. The aim was to create 60% soil disturbance. Scarification was done in March when the ground was fit to travel.

Hedges

Hedges in all 4 treatments were treated identically.

Experimental design

There were 4 treatments as described above and 26 sites. There are no replicates on each site. At each site there were 2 replicates of each margin seedmix.