

SAFFIE Final presentation

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September 2007

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The Voluntary Initiative



Sustainable Arable Farming For an Improved Environment - SAFFIE

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Funding acknowledgments



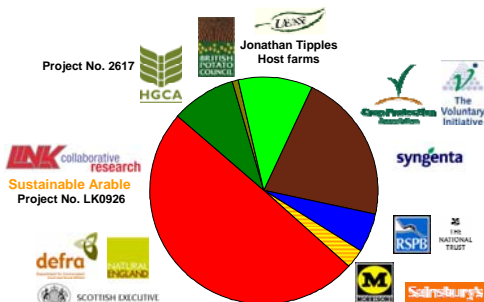
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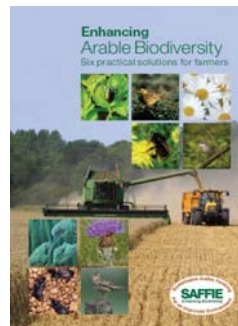
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Sources of funding



What is SAFFIE



- Major collaborative project (2002-2007)
- Part of Voluntary Initiative
- Developed six practical solutions for increasing biodiversity on arable farmland
- Full report and summary booklet available

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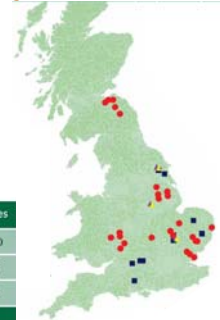
Why SAFFIE?

- **Arable farmland**
 - 20% of UK land area
 - Key habitat for biodiversity
 - 50% arable area in winter cereals
- **Arable farmers can adopt suitable practices**
 - Needs right signals
 - Different solutions for different species

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The SAFFIE project

- **Novel techniques tested at 3-10 sites**
- **Field-scale assessment of integrated effects on 26 sites across UK**



Novel techniques	Key	Duration	Sites
Wide-spaced rows & skylark plots	■	2001-03	10
Weed control programmes	▲	2001-05	3
Seed mixtures and novel margin management	▲	2001-06	3
Field-scale assessment			
Integrated treatments	●	2003-06	26

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Species monitored for diversity and abundance included:

Plants	Insects	Birds
Bird's foot trefoil	Bumblebees	Corn bunting
Cocksfoot	Butterflies	Linnet
Common knapweed	Beetles	Skylark
Ox-eye daisy	Harvestman	Whitethroat
Fescues	Lacewings	Yellowhammer
Timothy	Spiders	Yellow wagtail

+ yield, crop performance, farmer feedback

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SAFFIE tested:

- **In crop solutions**
 - Skylark plots
 - Wide spaced rows
 - Weed control programmes for desirable annuals
- **Margins**
 - Wildflowers in grass mixtures
 - Scarification
 - Mowing
 - Graminicide use

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Skylark plots

- Skylark population down 59% since 1970
- Winter cereals too dense for breeding success
- Compared normal crops with:
 - wide-spaced rows (2x normal row spacing)
 - undrilled 'skylark' plots (drill lifted out for about 4m)
 - All other treatments identical
- Tested on 10 farms for two years; further validated on 26 farms for three further years


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Skylark plots

- Skylark plots increased chicks reared by up to 50%
- Intermediate benefit from wide-spaced rows
- Increased foraging important
- Wider testing confirmed benefit
 - locate plots at least 50m (preferably 75m) from margins to reduce predation
- Also benefit to yellow wagtails, finches and buntings
- See CPA Best Practice Guide or RSPB leaflet

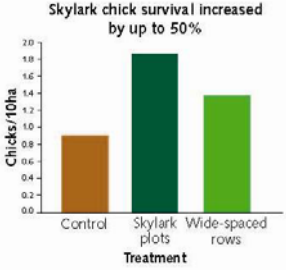
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Skylark plots


- Loss of cropped area £2/ha
- Potential costs for spraying – to make or remove weeds
- Real cost £2/ha to £12/ha
- Benefit up to £10/ha (10 points in ELS)
- Skylark chick survival increased by 50%

Skylark chick survival increased by up to 50%




Treatment	Chicks/10ha
Control	~0.9
Skylark plots	~1.8
Wide-spaced rows	~1.4


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In-crop biodiversity

- Few opportunities for desirable arable plants in modern wheat production
- Many plant species essential for insects and birds but have little effect on yield
- Aimed to control damaging weeds while leaving desirable species at non-competitive levels
- Eight herbicide programmes tested at three sites for three years
- Compared in conventional crops, wide-spaced rows and wide-spaced rows with cultivation (which aimed to stimulate germination)


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Which weeds do we want?


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


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In-crop biodiversity - key results

- Inter-row hoeing and wide-spaced rows did not encourage desirable plants and invertebrates
- Herbicides offered more opportunity to change plant species balance
- Difficult to generate biodiversity with high weed pressures
- Spring application and single treatment offer best solutions
- Implementation is site specific – may require expert advice from agronomist
- See also www.weedmanager.co.uk or www.arableplants.fieldguide.co.uk

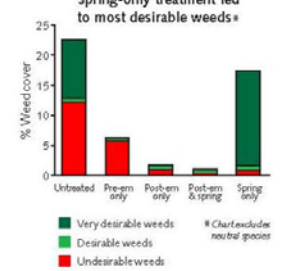
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In-crop biodiversity


- Potential to reduce herbicide costs on light soils by up to £10/ha
- Increased numbers of desirable species
- Very high weed numbers result in yield loss and do not help biodiversity
- Potential losses if done in wrong situation of 3 t/ha, up to £300/ha.


Spring-only treatment led to most desirable weeds*



Treatment	Very desirable weeds	Desirable weeds	Undesirable weeds
Unreated	~10%	~10%	~80%
Pre-em only	~5%	~5%	~90%
Post-em only	~2%	~2%	~96%
Post-em & spring	~1%	~1%	~98%
Spring only	~15%	~15%	~70%


* Chart exclude neutral species


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Margin mixtures

- Creating margins introduces new species
- Many environmental stewardship margins are based on low-cost, low maintenance grasses with limited biodiversity value
- Countryside Stewardship mix compared with fine grass + wildflowers and coarse/tussock grass + wild flowers
- Three sites for five years
- Monitored for wide range of impacts on biodiversity and adjacent crop agronomy


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Margin mixtures

Relative performance	Countryside Stewardship	Fine grasses & wild flowers	Coarse grasses & wild flowers
Establishment	██████████	██████████	██████████
Species richness	██████████	██████████	██████████
Desirable annuals	██████████	██████████	██████████
Beetles	██████████	██████████	██████████
Spiders	██████████	██████████	██████████
Butterfly & sawfly larvae	██████████	██████████	██████████
Bees & butterflies	██████████	██████████	██████████
Accessibility for birds	██████████	██████████	██████████
Bird species	██████████	██████████	██████████


- No single mixture best for all aspects of biodiversity
- No undesirable effects on crop were recorded


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Cost : Benefit – margin mixtures


- Countryside Stewardship mix £224/ha (or £45/ha/year if spread over five years)
- Wildflower mixes cost £1,200-£1,400/ha
 - Omitting poorly establishing species could save £200-£300/ha
- Cost of establishment and yield loss was £520-840/ha/year (if total cost is spread over 5 years);
- Increased bees, butterflies, bugs and birds by up to 80%
- 6m margin in ELS (EE3 @400 points/ha) could be worth £400/ha or £450/ha (some pollen/nectar @ 450 points/ha)

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Margin management

- Grass margins protect hedgerows, watercourses and field boundaries
- Around 25,000 ha under grass margins in UK
- Annual mowing limits biodiversity value
- Trials at three sites over five years
- Mowing compared with power harrow or graminicide in March/April

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Margin management treatment details

- Mowing – cut March/April
- Scarification – power harrow in March/April to a depth of 2.5cm to create 60% bare ground
- Graminicide – fluazifop-p-butyl applied at 0.8 l/ha in March/April






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Margin management

Relative performance	Mowing	Scarification	Graminicide
Species richness	██████████	██████████	██████████
Desirable annuals	██████████	██████████	██████████
Sward openness	██████████	██████████	██████████
Beetles	██████████	██████████	██████████
Planthoppers	██████████	██████████	██████████
Spiders	██████████	██████████	██████████
Butterfly & sawfly larvae	██████████	██████████	██████████
Bees & butterflies	██████████	██████████	██████████
Accessibility for birds	██████████	██████████	██████████
Bird species	██████████	██████████	██████████


- Scarification best after 3 years and tested further at 26 sites
- Graminicide also effective by end of five years
- Scarification new technique – cautious in adopting

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Cost : Benefit – margin management

- Costs of margin mixtures £520-840/ha/yr
 - Mowing £12.50/ha
 - Scarification £14.50/ha
 - Graminicide £17.50/ha
- Increased beetles and other insects, wildflowers, access for birds
- Benefit around £400/ha if EE3

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Encouraging birds

- Farmland birds are a government 'quality of life' indicator, an important measure of the health of the UK countryside
- Populations and ranges of many familiar species have declined by 50% since 1970
- Understanding interactions between management options important
- Four treatments tested on 26 sites over three years

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Encouraging birds - treatments

- Four treatments at 26 sites
- Each treatment (or plot) over 5 ha wheat
- Margins - grasses wild flowers scarified annually

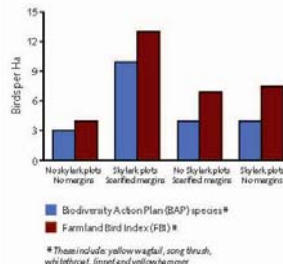
	Skylark plots	Scarified margins
1	✗	✗
2	✓	✓
3	✗	✓
4	✓	✗

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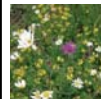


Encouraging birds

- Integrating both skylark plots and scarified wild flower margins gave additional benefits
- 3-4 fold increase in many key bird species
- Better access into crop and margins benefited birds, rather than an increased food supply
- Skylark predation greater if nests close to margins
- No additional costs over individual treatments



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SAFFIE – key findings

- Skylark plots increased chick numbers by up to 50%
- Wild flowers in field margins increased beneficial insects by up to 80%
- Selective herbicides only in spring, benefited biodiversity in crops
- Opening up grass margins improved farmland biodiversity
- Skylark plots with open margins increased farmland birds fourfold
- Environmental stewardship increased biodiversity benefits

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Enhancing biodiversity

- Simple measures can enhance arable biodiversity – careful management focused on specific results
- Identify objectives that:
 - Fit into your farming system
 - Include local landscape and historical features
 - Identify local species and your interests
- Manage for biodiversity
 - Integrate into farm plan
 - Suit your farm and locality
 - Variety of habitat and management techniques

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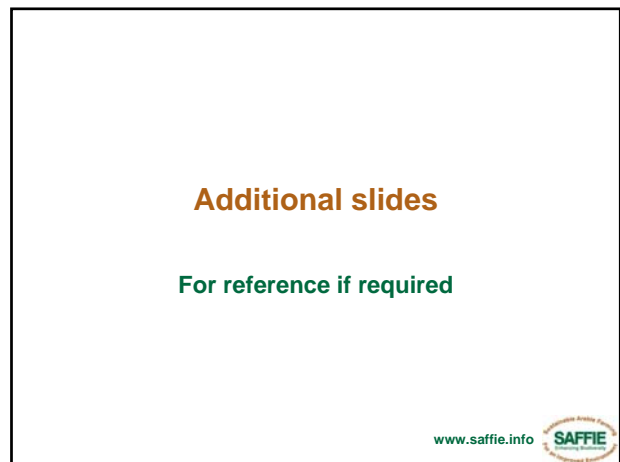
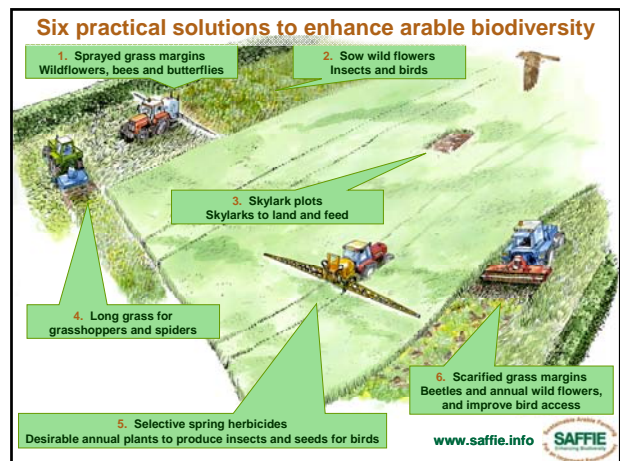
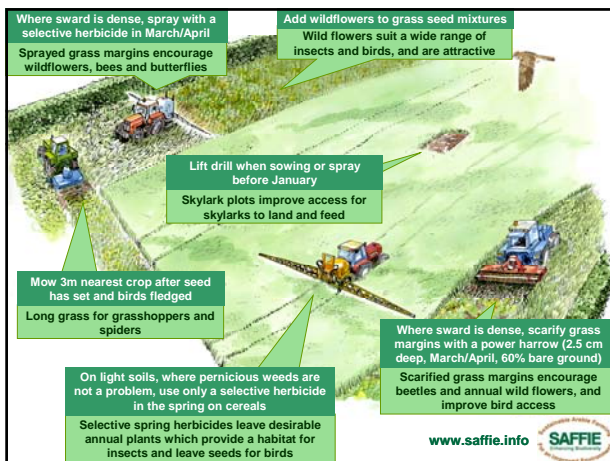
Six Practical Solutions

- In field
 - Skylark Plots
 - Selective spring herbicides in cereals
- Margins
 - Wildflowers in grass margins
 - Scarification
 - Mowing
 - Graminicide treatment

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Pressures

- **Economic** - Arable farmers need to optimise inputs and improve efficiency
- **Environmental** - UK commitment to increase biodiversity, especially farmland bird populations
 - Biodiversity Action Plans (BAPs)
 - Public Service Agreement (PSA)

SAFFIE aimed to reconcile these pressures by quantifying costs and environmental benefits of new techniques for farmers and policy-makers

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SAFFIE - specific objectives


1. Manipulate agronomy of wheat to increase biodiversity;
2. Manage margin vegetation to maximise biodiversity;
3. Assess the integrated effects of 'best' crop and margin management practices;
4. Conduct a cost:benefit analysis of the best practices;
5. Interact with the farming community to focus the work and promote findings.

1 January 2002 - 30 June 2007


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Skylark Ecology / Inhabit open areas – uplands, downland, coasts, farmland




Eats seeds, plants & insects
Nest on the ground



3-4 nesting attempts per season

The ecology and conservation of skylarks *Alauda arvensis*

52% decline in 30 years

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Problems for Skylarks



Autumn sowing results in loss of stubble for winter feeding.



Winter wheat becomes too tall & dense to allow skylarks to re-nest (and feed?).




Skylarks re-nesting next to tramlines susceptible to machinery & predators.


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SAFFIE Techniques


Technique	In ELS	Biodiversity benefits	Best suited to	Avoid
In field	✓	Skylarks, buzzards, yellow wagtail	Large open fields in winter cereals	Siting close to field margins and trees Sites with resistant black-grass
	X	Desirable arable plants, insects	Light soils Known desirable plants Low weed pressure Late-sown crops Spring crop rotation	Heavy soils Known populations of perennial or resistant weeds Seed crops
Margins	✓	Bees, butterflies, bugs, birds	Field corners Hedgerows Inferile sites	Highly fertile sites Nutrient application in preceding year Areas prone to fly tipping and trespass
	X	Beetles, bird acorns, bare ground, annual plants	Low populations of perennial weeds Dense swards Natural England permission required	High seed bank of perennial weeds Soils susceptible to erosion Very wet sites Cutting in 2m cross-compliance strip
	✓	Planthoppers, spiders, grasses	Thin swards Mowing after fledging and seed set	Mowing 2m nearest the hedge
	X	Perennial plants, planthoppers, spiders, birds	Dense swards with wild flowers Natural England permission required	Near watercourses Spraying 2m cross-compliance strip Sward with susceptible grasses and no wild flowers

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Reporting



- Final report on HGCA web site (www.hgca.com/publink.aspx?id=3919)
- 'Enhancing Arable Biodiversity - Six practical solutions' booklet produced
- SA LINK report
- PPT presentation on SAFFIE web site
- Several scientific papers already written – more to follow
- See www.saffie.info for more details

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Some published papers

Winspear R. and Davies G. 2005. A management guide to the birds of lowland farmland. RSPB, Sandy.


Woodcock, B.A., Westbury, D.B., Potts, S.G., Harris, S.J. & Brown, V.K. (2005) Establishing field margins to promote beetle conservation in arable farms. *Agriculture Ecosystems & Environment*, 107, 255-66.

Smith, B.M. & Jones, N.E. 2007. Effects of manipulating crop architecture on weed and arthropod diversity in winter wheat. *Aspects of Applied Biology* 81 2007: Delivering Arable Biodiversity

Henderson I.G., Morris A.J., Westbury D.B., Woodcock B.A., Potts S.G., Ramsay A. & Coombes R. 2007. Effects of field margin management on bird distributions around cereal fields. *Aspects of Applied Biology* 81 2007: Delivering Arable Biodiversity

Ramsay A. 2007. Arable planthoppers and their responses to novel margin management. *Aspects of Applied Biology* 81 2007: Delivering Arable Biodiversity

Morris A.J. 2007. Overview of the SAFFIE project. *Aspects of Applied Biology* 81 2007: Delivering Arable Biodiversity

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