

Designing multifunctional field margins for biocontrol in wheat-oilseed rape rotations

Sam M. Cook

AgroEcology Department, Rothamsted Research, UK



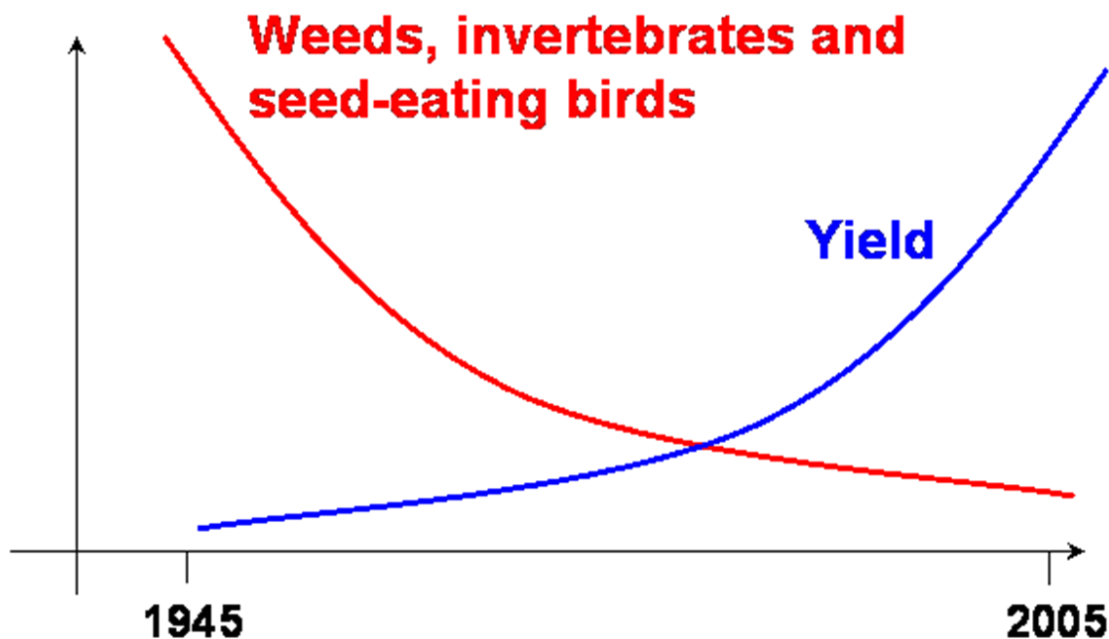
IOBC-WPRS
OILB-SROP

IOBC co-coordinator of Working Group
Integrated Control in Oilseed Crops



The problem...

- High input agricultural intensification has led to fragmentation of semi-natural habitats and loss of biodiversity



Aebischer 1991
Krebs et al. 1999

Firbank 1998
Chamberlain et al. 2000

Siriwardena et al. 1998
Robinson & Sutherland 2002

The problem...

Initial comprehensive review of farmland wildlife found:



- 67% of moths declining
- 71% of butterflies declining
- 54% of birds declining
- 28% of vascular plants declining

Thomas *et al.* (2004) *Science*, **303**, 1879-1801

A solution – Field margins



- Areas of uncropped land, between the arable crop and the boundary structure (e.g. hedge)
- Actively managed; sown to annual but usually biennial or perennial plants; 1-6m wide
- Introduced in several countries as part of Agri-environment schemes (EU CAP)
- UK countryside stewardship scheme

A solution – Field margins Good for birds!

- Tussocky grass margins when left uncut can :
 - provide seed (bird food),
 - support insects (bird food)
 - provide nesting sites
- Specialist 'Bird Food' mixtures commercialized



A solution – Field margins Good for pollinators!

- Field margins including wild flowers:
 - provide pollen & nectar for insects, especially bees & butterflies
- Specialist 'Nectar-rich' mixtures commercialized

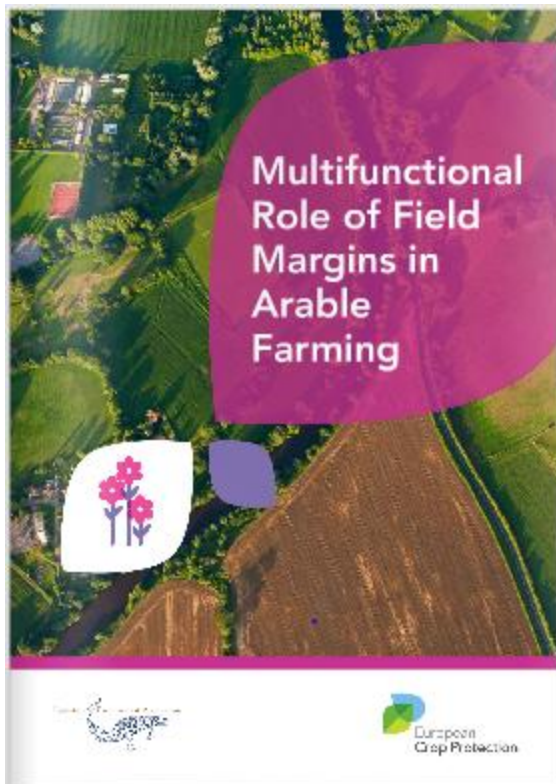


A solution – Field margins Good for biocontrol?

- Natural enemies of crop pests can provide biocontrol services
- Supporting naturally occurring natural enemies = **conservation biocontrol**
- Field margins central to conservation biocontrol...
...**but no specialist mixtures!**
- Grassy margins support cereal aphids and their natural enemies e.g. Holland et al., 2012 Ag. Ecosyst. Env. 155:147-152
- Nectar-rich mixtures can attract others



Multifunctional field margins?



European Crop Protection Agency

Increasing interest in
'Multifunctional' field margins
i.e. those that serve several
ecosystem functions

Optimising mixtures for
biodiversity and **biocontrol**

Across the crop rotation

www.rothamsted.ac.uk/field-margins

Do margins containing brassicas improve biocontrol in crops of the rotation?

- PURE Workpackage 10 - Ecological engineering for IPM: from field to landscape (Graham Begg, JHI)
- Task 10.2: Deployment of plant diversity for conservation biocontrol of arthropod pests (Gabor Lövei, AU)
- Joint field experiment on 2 sites (Aarhus (AU) & Rothamsted Research (RRes) to investigate effect of margins containing Brassicas on biocontrol in wheat and OSR crops

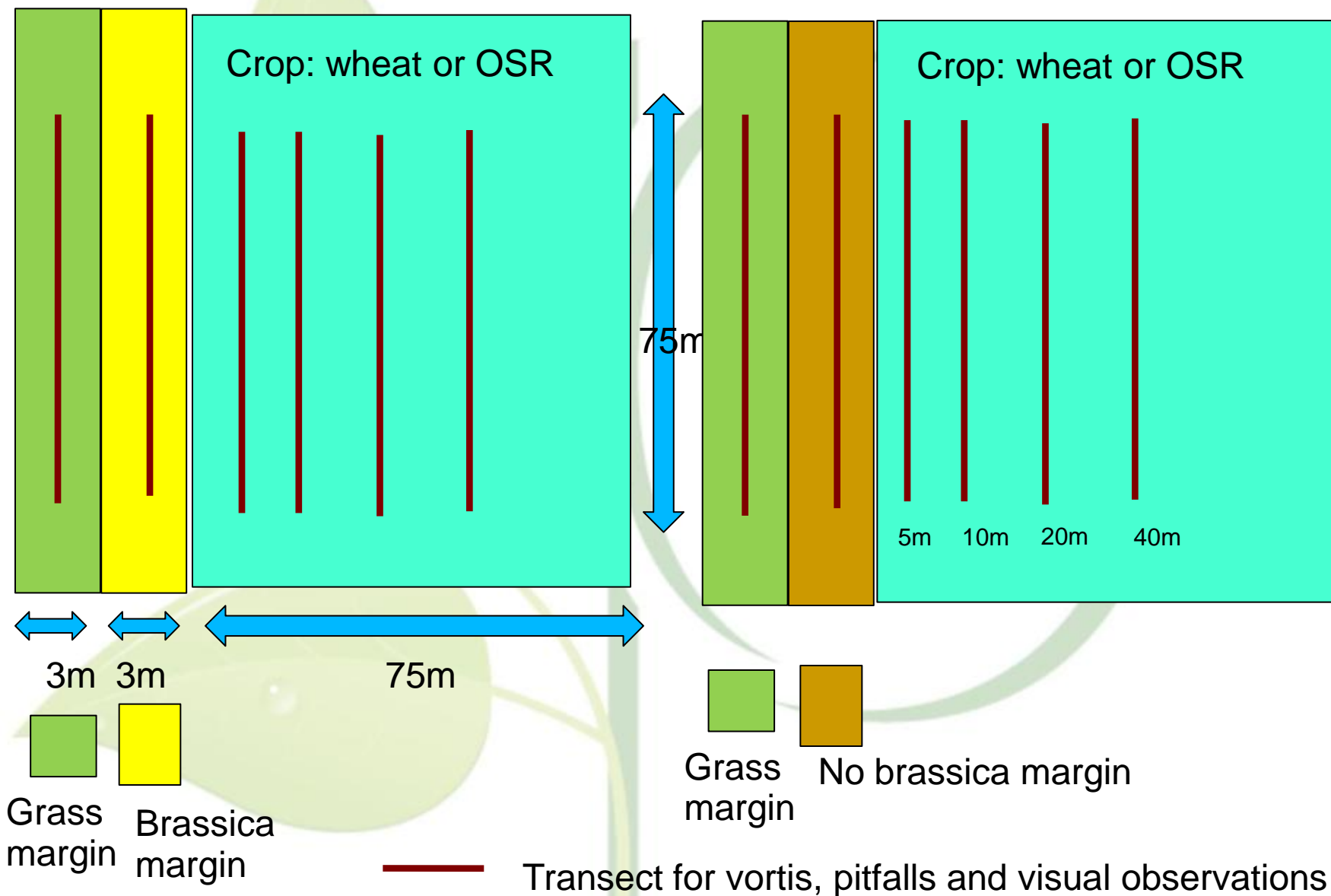
For AU results please see poster #8

Manipulating field margins to increase predation intensity in winter wheat (*Triticum aestivum*) fields in Denmark

Marco FERRANTE, Agathe MANSION-VAQUIÉ, Gabor L. LÖVEI
Aarhus University, Department of Agroecology, Flakkebjerg Research Center, Forsgøvej 1, DK4200 Slagelse, Denmark; Marco.Ferrante@aarsci.dk



10.2 RRes Field Experiment (4 treatments; 3 replicates; 2 years)



The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/ 2007-2013) under the grant agreement n°265865- PURE

Do margins containing brassicas improve biocontrol in crops of the rotation?

Vortis Suction sample data

74 sp. from wheat ; 72 sp. from OSR
crops pests & their natural enemies
most abundant

Wheat

Aphid parasitoids > orange wheat blossom midge > cereal aphids > Linyphiid money spiders

OSR

Pollen beetle > PB parasitoids > stem weevils parasitoids > seed weevil parasitoids > seed weevils



Burkard



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Do margins containing brassicas improve biocontrol in crops of the rotation?

Pitfall trap data

Wheat

- *Pterostichus madidus* & *P. melanarius* (Carabid beetles),
- Linyphiidae (small 'money spiders')
- Lycosidae (predatory wolf spiders) & Tetragnathidae (long jawed spiders)



- No significant differences between margin treatments
- Tetragnathidae long jaw spiders decreased with increasing distance into crop



Do margins containing brassicas improve biocontrol in crops of the rotation?

Pitfall trap data

Oilseed rape

- *Nebria salina* (Carabidae)
- Staphylinidae
- Linyphiidae (small 'money spiders')
- Lycosidae (predatory wolf spiders), and Tetragnathidae (long jawed spiders)
- More spiders and several carabid spp in OSR crops next to brassica margins than grass margins

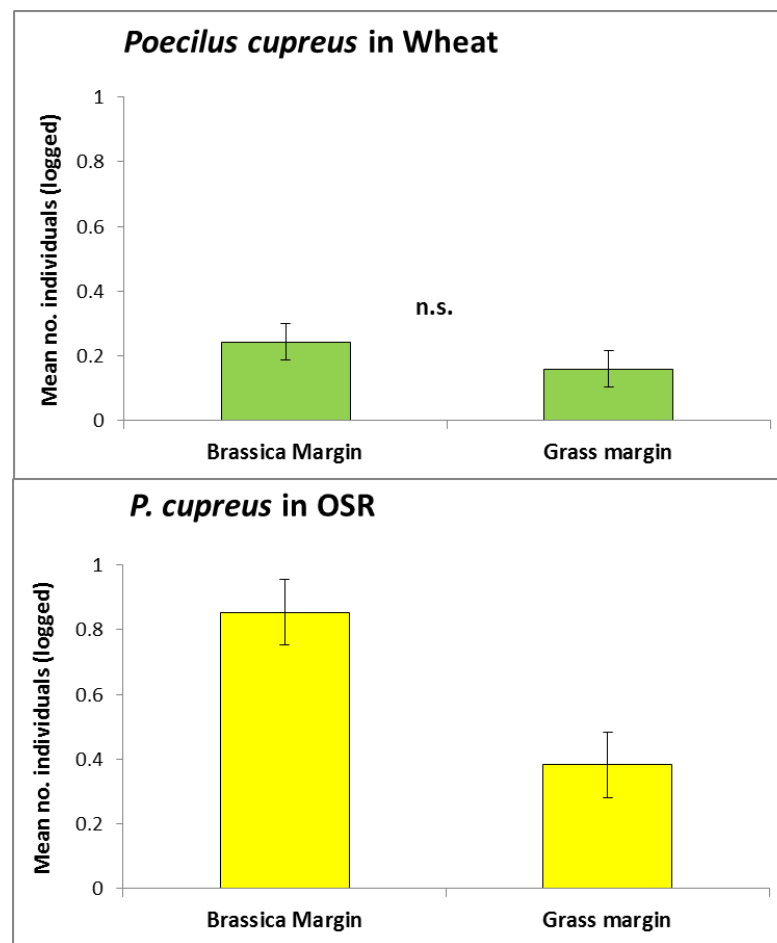


Do margins containing brassicas improve biocontrol in crops of the rotation?

Poecilus (formerly *Pterostichus*) *cupreus*



- Known to be associated with OSR
- Brassica margins further enhance numbers found in OSR crops



Do margins containing brassicas improve biocontrol in crops of the rotation?

(Preliminary) Conclusions

- Brassica margins increase biodiversity and biocontrol agents at field edges, particularly specialists
- Abundance tends to decrease with distance into the field
- Little evidence of significant biocontrol effects
- Challenge for future:
 - move biocontrol agents into the open field
 - show positive effects on yield



Thank you

Dr Graham Begg (JHI) for leadership of PURE WP 10



Dr Judith Pell (JK Pell Consulting)

J. K. Pell Consulting

DR Gabor Lövei (AU, Denmark)



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