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# Improving establishment: Does companion cropping work?

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## Cabbage stem flea beetle (*Psylliodes chrysocephala*)



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What happened in 2014?

c.5 % crop lost nationally; (70%) in East / South-East



Since the ban on neonicotinoid seed treatments, OSR establishment has been threatened by Cabbage stem flea beetle



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# Crop management methods to improve establishment

**Farmers have reacted to problems with CSFB at establishment by:**

- Sowing early (end of July/start of August)
  - Using hybrid varieties (vigour)
  - Increasing seed rate
  - Undersowing / companion planting  
e.g. vetch, clovers, buckwheat, etc...
- evidence of efficacy in reducing CSFB damage?







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# Reducing CSFB damage by companion planting

- Companion planting methods include e.g. intercropping, trap cropping, undersowing etc.



- These methods can improve pest control, pollination, weed control, and provide habitat for increased farmland biodiversity



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# Reducing damage by companion planting – Trap crops

**Trap crops – plant stands of more attractive growth stage or species than target crop, planted in proximity to lure pests away from colonizing the main crop**

Turnip rape *Brassica rapa* -preferred by several insect pests of OSR:

pollen beetles and seed weevils in flowering stages... e.g. Cook et al (2006) *Ent. Exp. Appl.* 119:221-229 ; Cook et al (2007) *APIS* 1: 57-67



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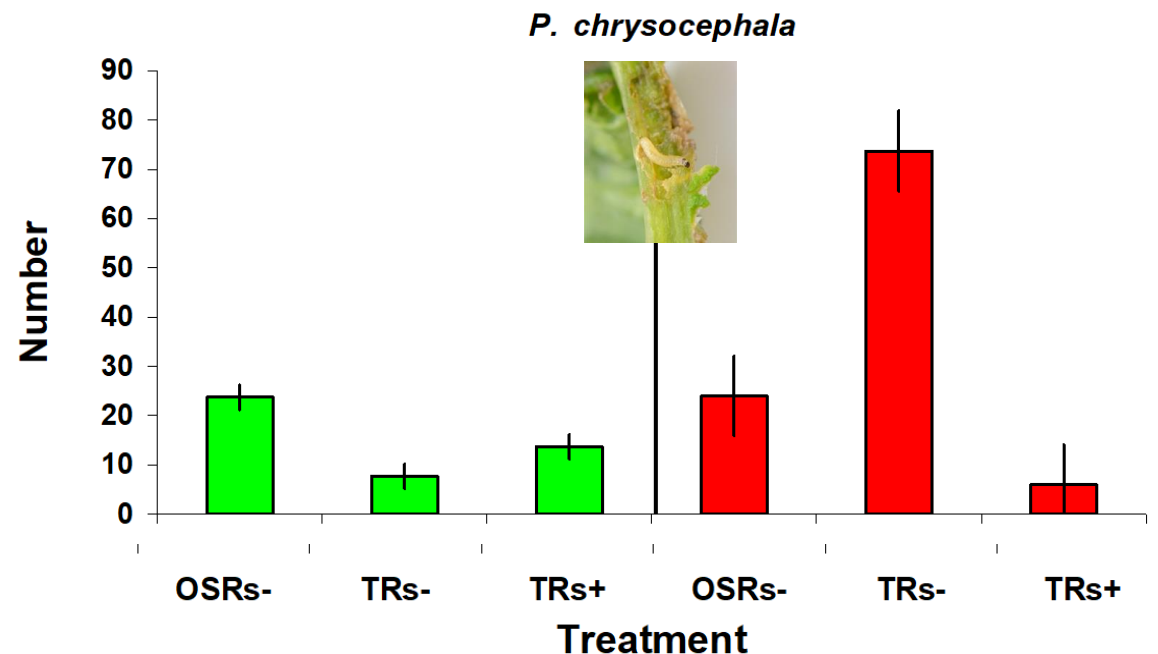
# Reducing damage by companion planting – Trap crops

2005: Replicated plots of OSR with or without borders of turnip rape *Brassica rapa* (which were either sprayed or unsprayed):

CSFB preferred turnip rape over OSR for oviposition

**Oilseed rape crop centres**  
[unsprayed oilseed rape (OSRs-)]

**Trap crop border strips**  
[TR (sprayed/unsprayed) or OSRs-]





# Reducing damage by companion planting – Trap crops

2005: Replicated plots of OSR with or without borders of turnip rape *Brassica rapa* (which were either sprayed or unsprayed):

CSFB preferred turnip rape over OSR for oviposition

Larval populations reduced in OSR plots with turnip rape compared to control

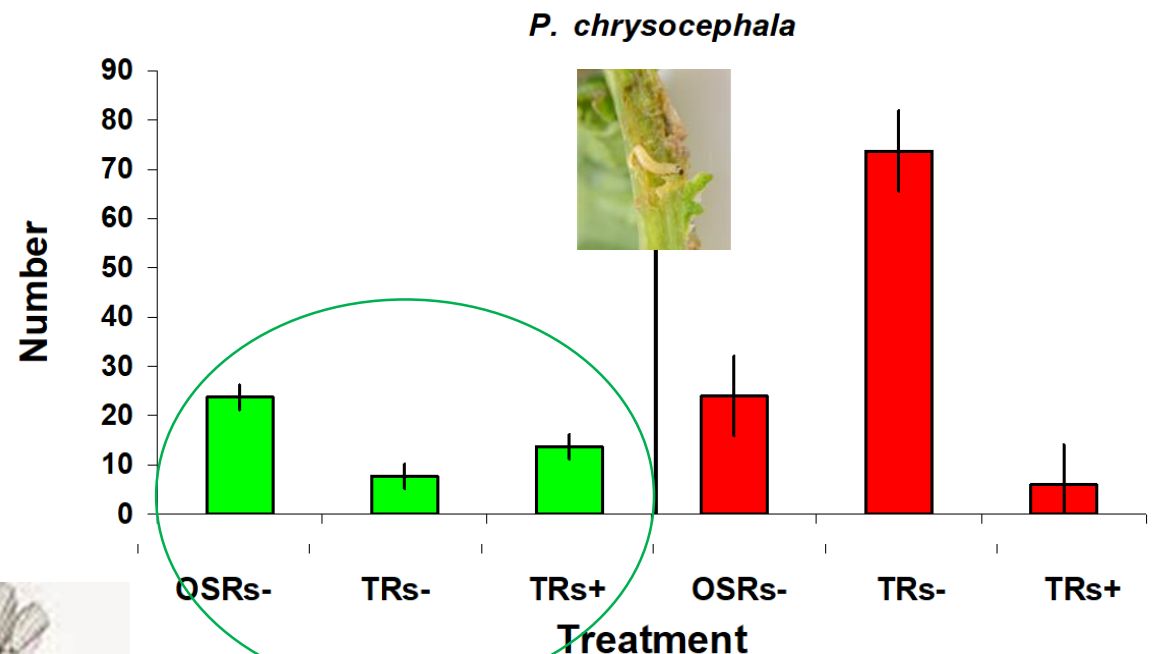
CSFB larval parasitoid *Tersilochus microgaster* Szép. described for 1<sup>st</sup> time in UK: Attacked larvae in turnip rape but not oilseed rape



*Tersilochus microgaster*

**Oilseed rape crop centres**  
[unsprayed oilseed rape (OSRs-)]

**Trap crop border strips**  
[TR (sprayed/unsprayed) or OSRs-]





# Reducing damage by companion planting – Trap crops



2015: Replicated plot trials: OSR (9x9m) with and without turnip rape borders (1m)



- Plant density in plots with trap crop significantly higher than control plots
- Significant reduction in CSFB adult feeding damage and larval infestation in OSR with turnip rape trap crop (trial abandoned Jan 2016)





# Reducing damage by companion planting – ‘undersowing’

2015: Replicated plot trials: OSR (12x2m) with 3 undersown mixtures (Funugreek, Brassica mix, clover mix and OSR control each at 4 seed rates (60, 80, 100, 120 seeds/m<sup>2</sup>)



Duncan Coston



Simon Kightley, NIAB TAG



- CSFB feeding damage was reduced with increasing seed rate
- CSFB feeding damage was reduced in plots with the Brassica mix



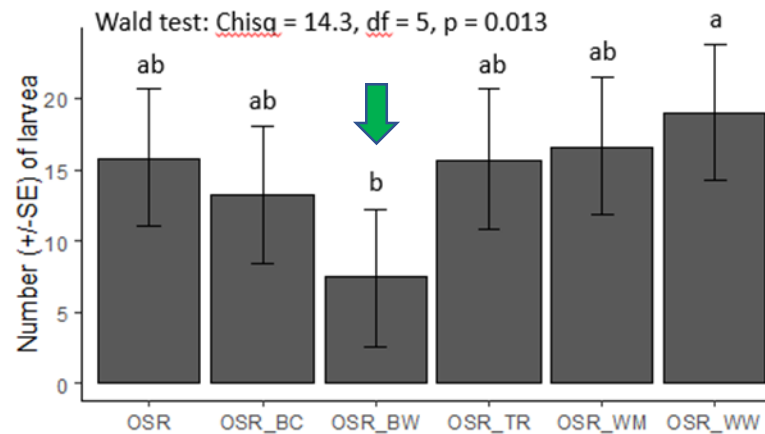
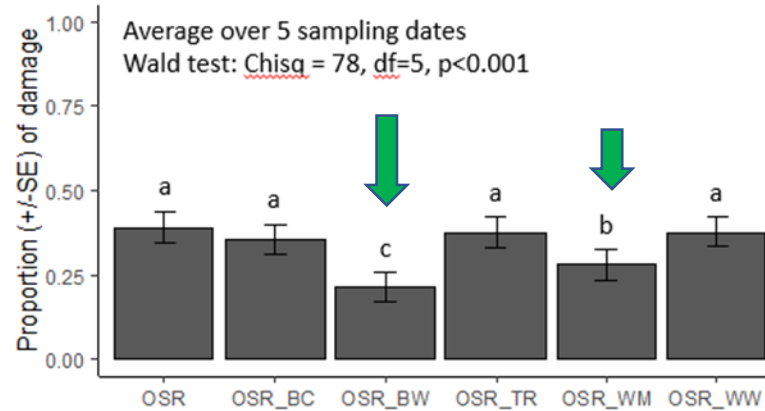
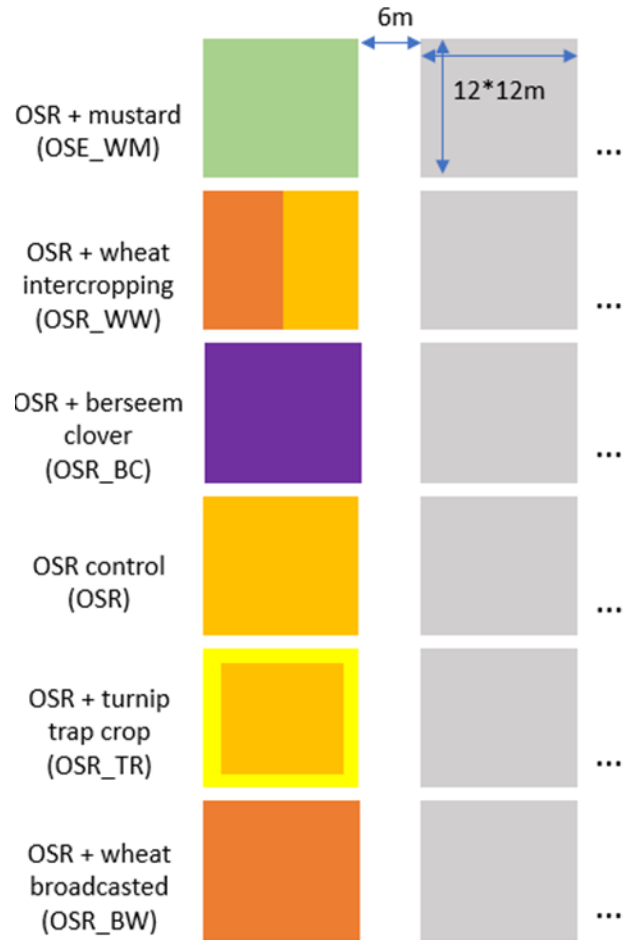
Coston (2020) PhD ; Coston et al., *in prep*

# Reducing damage by companion planting



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2019: Replicated plot trials (6x6m) OSR crops testing:



Significant reduction in feeding damage in broadcast wheat and white mustard plots



# Reducing damage by companion planting – ‘undersowing’



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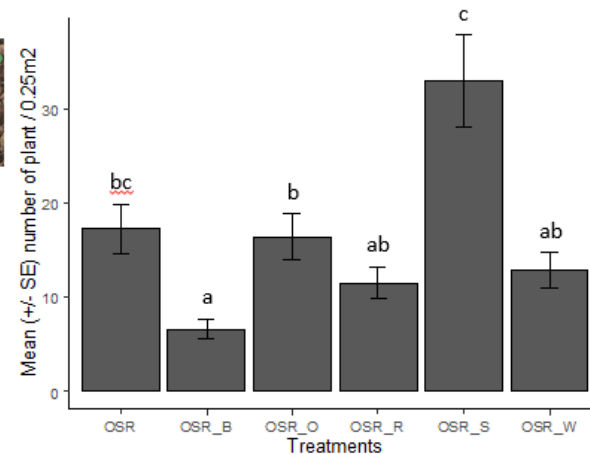
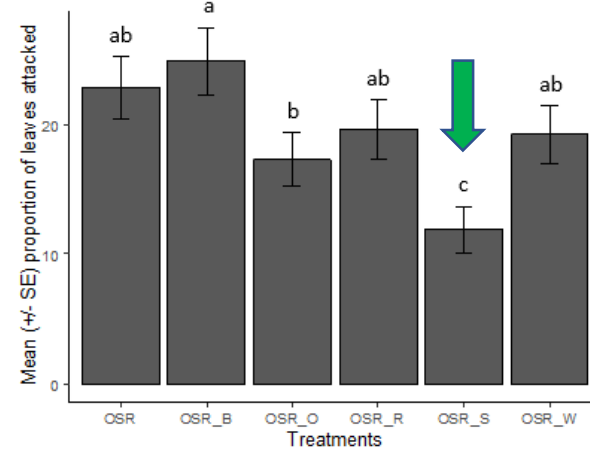
2020: Replicated plot trials (3x9m) of OSR crops testing broadcasted cereals:

6 treatments: control (OSR), barley (OSR\_B), oat (OSR\_O), rye (OSR\_R), wheat straw (OSR\_S), wheat (OSR\_W)

6 replicates, OSR cv Barbados

Small plots (3x9m) but no space between plots

CONTROL (OSR ONLY NO UNDERSOWING)	13	OSR + WHEAT	1
OSR + BARLEY	14	OSR + RYE	2
OSR + OATS	15	OSR + WHEAT STRAW MULCH	3
OSR + WHEAT STRAW MULCH	16	CONTROL (OSR ONLY NO UNDERSOWING)	4
OSR + RYE	17	OSR + WHEAT	5
OSR + OATS	18	OSR + BARLEY	6
OSR + WHEAT STRAW MULCH	19	OSR + RYE	7
CONTROL (OSR ONLY NO UNDERSOWING)	20	OSR + BARLEY	8
OSR + WHEAT	21	OSR + OATS	9
OSR + RYE	22	OSR + WHEAT STRAW MULCH	10
CONTROL (OSR ONLY NO UNDERSOWING)	23	OSR + WHEAT	11
OSR + BARLEY	24	OSR + OATS	12



Data averaged over 3 sampling sessions

# Does companion cropping work to improve establishment?



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- Evidence to suggest turnip rape trap cropping, under-sown brassica mixtures/white mustard, under-sown cereals (wheat, oats) improves establishment and reduces CSFB damage
- Need to scale-up! Small plot trials are unrealistic and suffer from neighbor effects...
  - 2021: Large-scale replicated tramline trials on commercial farms: turnip rape trap crops, berseem clover, microclover
- Understand mechanisms of action so that effects can be optimized
- Effect of companion plants on biodiversity -pest regulators and pollinators





# Thank you!



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Ingrid Williams  
Suzanne Clark



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Duncan Coston  
Lin Field

Gaëtan Seimandi-Corda  
Todd Jenkins

Simon Kightley



Tom Breeze  
Simon Potts



**Elsoms** for providing Cruiser seed treatment 2016  
**Dupont** for provision of Lumiposa 2016