



Interreg
North Sea Region
BEESPOKE
European Regional Development Fund



Impacts of Wildflower Interventions on Beneficial Insects in Fruit Crops: A Review

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1. Background

- Post WWII there was a drive to intensify agriculture
- By 1984 in lowland England and Wales semi-natural grassland had declined by 97% compared to previous 50 years
- Only 7,500 ha remained by 2010

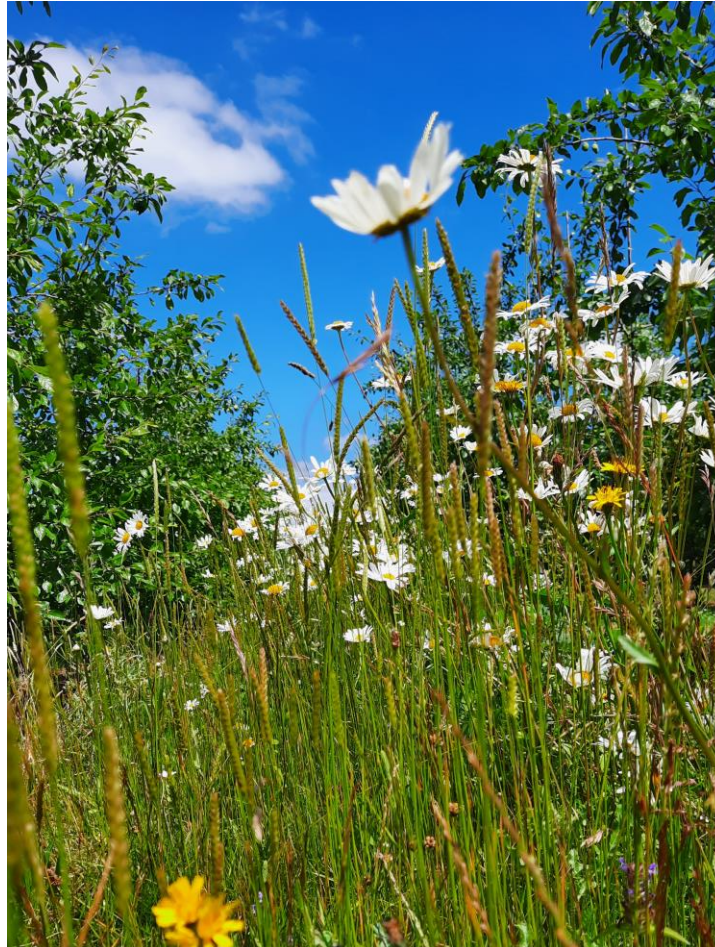


UK Fruit Production

- Sown alleyways of a grass sward
- *Lolium perenne*,
Festuca spp. and
Poa pratensis



Why are Floral Resources important to horticulture?



- Generally implemented for food and nesting resources in local landscape
 - Natural enemies
 - Pollinators
 - Biodiversity
- Improve pest regulation, pollination and ecosystem
- Resilience for future environmental changes

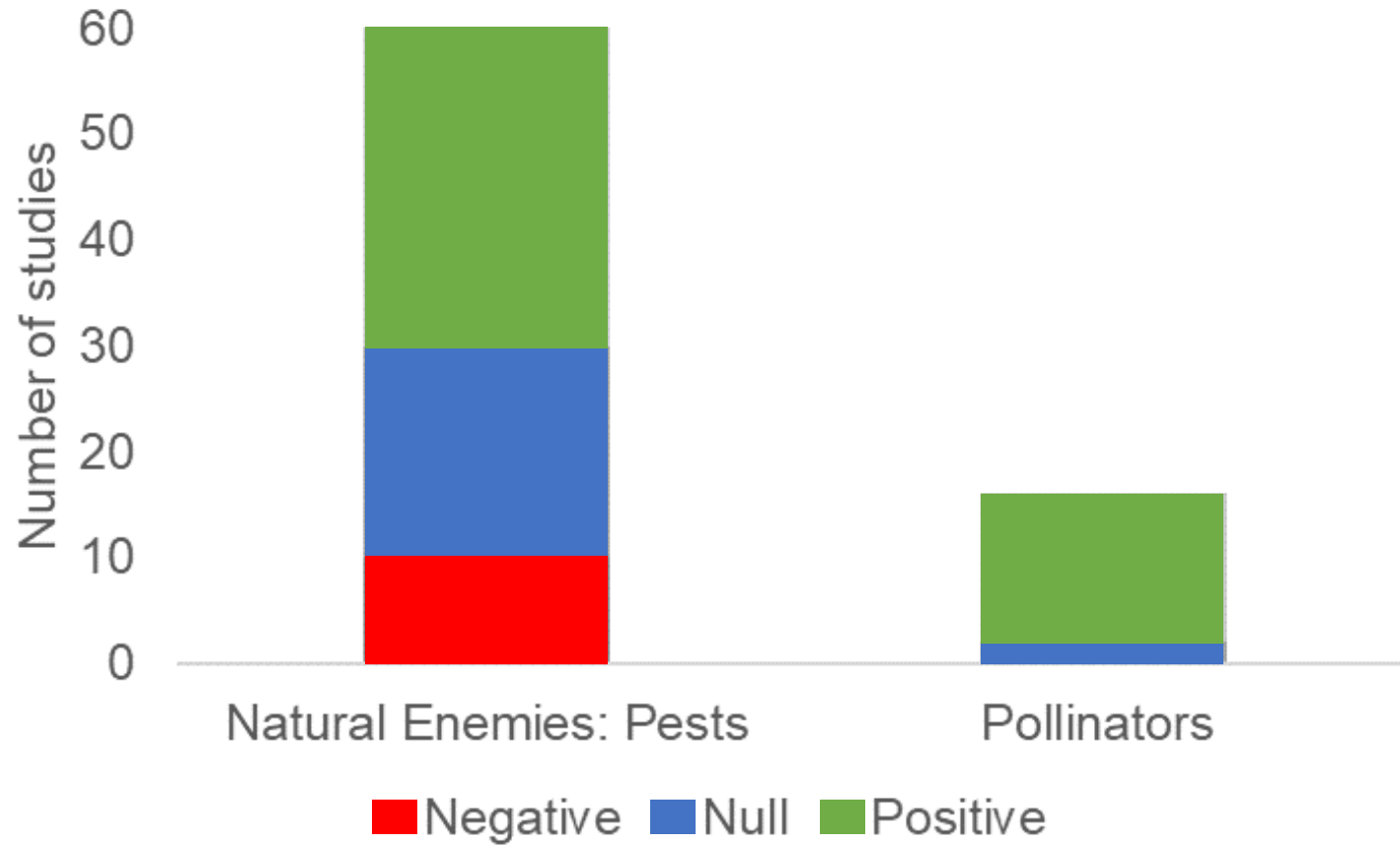
Added Benefits

- Soil protection
- Water quality
- Weed suppression
- Enhanced rural aesthetics



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2. Impacts of floral resources on pests and natural enemies

- Capsids and tortrix ↓
- Codling moth larvae and damaged fruits ↓
- RAA increase, WAA suppression ↓
- Promotion of aphidophagous and generalist predators ↑



2. Impacts of floral resources on pollination and production

- Fruit crops high reliance on insect pollination
- Increase in flower visits to crop 
- Sometimes, results in an increase in production, depending on crop and context 



3. Does period a floral resource is in place impact benefits?

- 6 vs 1 year
- Predators numbers
- Predatory-prey ratios
- First year
- spring aphids
- codling moth
- 3-4 years
- pollinator numbers and diversity



4. Composition

- Sward architecture, plant diversity and species richness
- Contrasting with local environment in landscape
- Connectedness: nesting habitat, nesting material, structure, shelter sites
- Nutritional quality - effect on longevity and fecundity
- Provide resource later in the season



Leontodon hispidus, *Centaurea cyanus*, *C. nigra*, *Taraxacum* spp., for nectar, *Papaver rhoeas*, *Malva moschata* for pollen



4. Structure

- Plant size influences numbers of beneficials
- Increase sward architecture, increases fauna biomass
- Repeated mowing negatively impacts wild bees
- Reduce mowing regimes to increase NE
- Cutting every other row on a rotation
- 20 cm vs single autumn cut

5. Size?

- Semi-natural habitats key to wild bee diversity in agriculture
- Purpose-sown flora offer higher flower abundance than some semi-natural grasslands
- ~2% flower-rich habitat and 1 km flowering hedgerow sufficient for 6 common pollinators
- Several small fragments vs one large area support more butterflies and parasitoids
- Small habitat areas - scattered to maximize diversity and minimize species loss



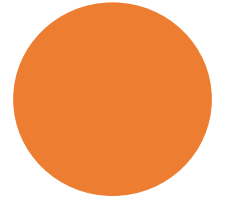
6. Distance and edge?

- Margins; spill-over into cropping areas
- Fauna respond according to size, mobility and reliance upon a nest site
- NE abundance decreases with increasing distance from field border
 - Spiders 60 m
 - Hoverflies 180 m
 - Aphidophagous hoverflies 17.5 m
 - Parasitoid wasps up to 30 m






6. Distance and edge? Pollinators

- Areas of flower rich habitats within 500-1000 m improved richness of hoverflies and bees
- Honeybee – halved - 2,170 m
- Pollinator species richness – halved - 1,500 m
- Bumblebee forage distance - 272-551 m
- Solitary bees within **150 m** of solitary bees nesting resource



7. Benefits of floral resources to pest control

- In general, crops with enhanced ground cover have;
 - lower pest levels,
 - greater number of species,
 - higher abundance of predaceous arthropods,
 - higher removal rates of prey
- Spiders, parasitic wasps, lacewing adults, anthocorids and ladybirds 
- Parasitism 
- Phytophagous insects, alternative prey for natural enemies 
- Alternative prey, e.g., earlier in the season



7. Pest control

- Pesticides can cancel out benefits
- Key pests not completely controlled to commercially acceptable level
- Higher thresholds for pests not directly damage fruits
- Floral resources can boost local levels of NE negating need for some insecticide applications



7.3. Recorded detrimental effects of floral resources

- Avoid alternative hosts and botanically related to crop
- Postharvest storage rots with white clover cover crops
- Common green capsid, though not damage
- Woolly apple aphid - first year after establishment
- Frog hopper *Philaenus spumarius* – vector of *Xylella fastidiosa*
- Distraction not clear, e.g. earwigs and pollinators



10. Overall conclusions

- Areas of species rich and abundant floral resources provide;
 - food (pollen nectar, nectar, vegetation, and prey),
 - nesting sites,
 - structure to build,
 - area of refuge in poor weather and for diapause during the winter
- Less interannual variability



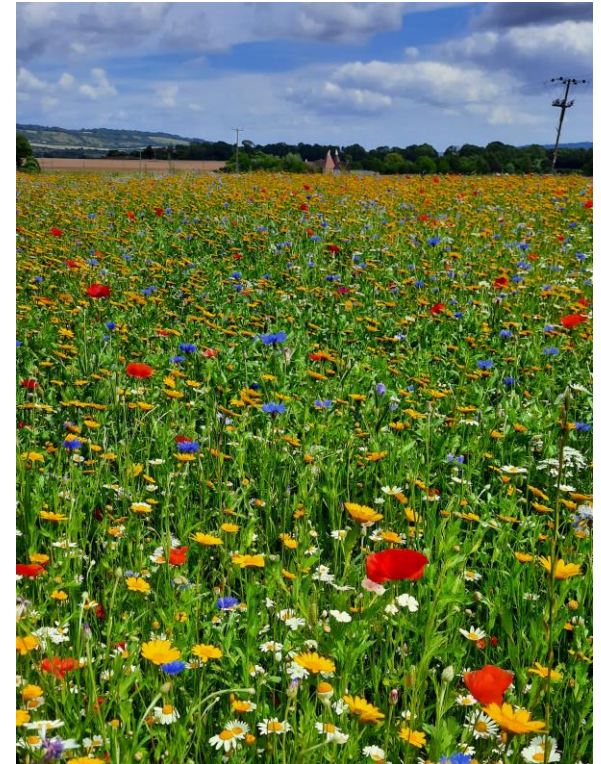
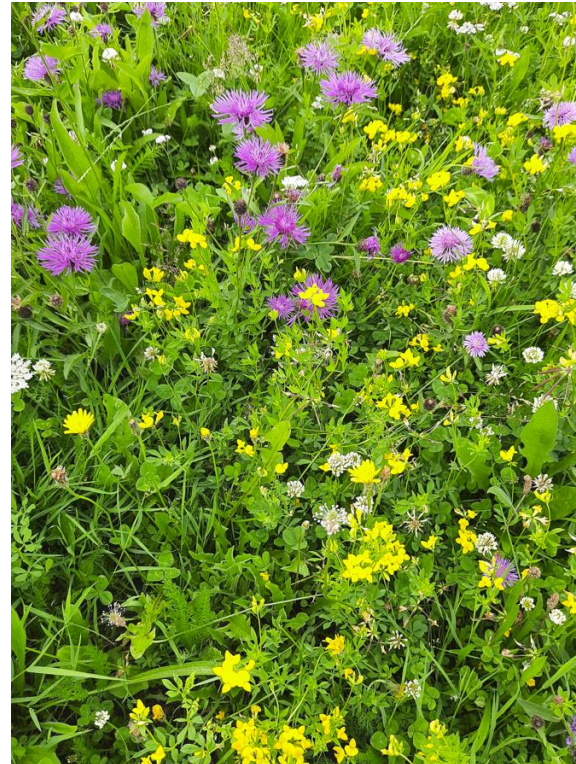
10. Overall conclusions

- Floral resource performance depends on;
 - quality,
 - location, proximity to crop,
 - landscape, connectivity,
 - pesticide use,
 - and management



10. Overall conclusions and future directions

- Fruit crops grown in rows or on elevated structures allow alleyways and understory to be sown
- Future: tailored floral mixes to specific crops - highest benefit, lowest negative impacts



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- **Impacts of Wildflower Interventions on Beneficial Insects in Fruit Crops: A Review**





Thank you
for listening