Agroforestry and pollination

Reference 1

Staton, T; Walters, RJ; Smith, J; Girling, RD. 2019 Evaluating the effects of integrating trees into temperate arable systems on pest control and pollination. Agricoltural systems 176, 102676. doi: 10.1016/j.agsy.2019.102676

Background and objective

Global crop demand is rising rapidly, and is forecasted to increase by 100110% from 2005 to 2050. The intensification of arable production in temperate regions has driven declines in biodiversity and associated ecosystem services, such as pest control and pollination. There is a strong and growing pressure to move towards more sustainable intensification of production, through harnessing natural processes to sustain productivity rather than relying on pesticides and managed pollinators. Agroforestry has been proposed as a winwin opportunity for productivity and environmental protection. 1) collate and analyse studies of pollinators, pests and their natural enemies in temperate silvoarable systems, specifically in terms of their potential contribution to pest control and pollination ecosystem services; and 2) develop a framework for future research to predict the factors which influence variation in results, with the aspiration of driving forward a unified research agenda. Here we report only results on pests control and natural enemies of pests.

Search strategy and selection criteria

Publications were searched in Web of Science. To minimise the risk of publication bias, both peer-reviewed and non-peer-reviewed literature, including theses and reports (British Library EThOS thesis search) and personal communications were sourced. 1. A measure of abundance or activity density of invertebrate herbivores/pests, natural enemies or pollinators, and/or a measure of conservation biological control of animal pests and/or pollination were recorded; 2. Studies were undertaken in a temperate region, defined as latitude> 40° north or south; 3. A silvoarable system, for this purpose defined as trees or shrubs incorporated into an arable field, was compared with an arable control, with the respective arable components comprising annual crops. To minimise the risk of publication bias, we sourced both peer-reviewed and non-peer-reviewed literature, including theses and reports.

Data and analysis

The significance of effects for herbivore/pest and natural enemy abundances were analysed in a mixed-effects meta-analysis model, using the rma.mv function of the metaphor package version 2.1-0 (Viechtbauer, 2010) within R version 3.5.2 (R Core Team, 2018). As multiple data points were extracted from some individual studies, study ID was included as a random effect.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
3	Temperate arable systems	Silvoarable agroforestry systems.	Crop monocultures.	Logarithm of ratio (backtransformed to ratio) of abundance of pollinators in silvoarable systems to abundance in crop monoculture.	94%

Results

- Relatively to pollinator abundance the effect sizes ranged from 1.17 to 2.55, indicating beneficial effects on pollinator populations in silvoarable systems compared with arable controls, but study replication was low.

- One study also reported higher California Poppy phytometer seedset by a factor of 4.5 in agroforestry compared with arable systems.

- NA

- NA

- NA

Factors influencing effect sizes

Results can be affected by the proximity of landscape features (forest plots or boundary hedgerows), soil type and alley width

Conclusion

Pollinators were more abundant in silvoarable than arable systems, but study replication was low.