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Albrecht, M; Kleijn, D; Williams, NM; Tschumi, M; Blaauw, BR; Bommarco, R; Campbell, AJ; Dainese, M; Drummond, FA; Entling, MH; Ganser, D 2020 The effectiveness of flower strips and hedgerows on pest control, pollination services and crop yield: a quantitative synthesis *ECOLOGY LETTERS*, 23(10), 1488-1498. 10.1111/ele.13576

Background and objective

The lack of clarity about effects of flower plantings on ecosystem service provisioning and crop yield scattered in numerous case studies is a barrier to farmer adoption of such measures. The aim was to quantitatively assess the effectiveness of two of the most commonly implemented ecological intensification measures, flower strips and hedgerows, in promoting crop pollination, pest control services and crop production. Moreover, the authors aim to better understand the key factors driving failure or success of these measures to suggest improvement of their design and implementation.

Search strategy and selection criteria

The authors performed a search in the ISI Web of Science and SCOPUS (records published until 31.12.2017 were considered). To minimise potential publication bias and to maximise the number of relevant data sets they also searched for unpublished data by contacting potential data holders through researcher networks. 1) Pollination and/or pest control services in crops were measured in both crop fields adjacent to floral plantings and control fields without planting; 2) the replication at the field level was \geq six fields per study (three fields with plantings and three without; i.e. disqualifying small-scaled plot treatment comparisons within fields).

Data and analysis

The authors used a mixed effect-modelling approach to address the research questions. In all models, study was included as a random intercept to account for the hierarchical structure of the data with field measures nested within study. Effect sizes provided in the text and figures are model estimates of z-transformed response variables. For statistical inference of fixed effects log-likelihood ratio tests (LRT) were used. All statistical analyses were performed in R version 3.5.2 using the R-package lme4.

| Number of papers | Population | Intervention | Comparator | Outcome | Quality score |
|------------------|------------|--------------------------------|--------------------------------------|---|---------------|
| 35 | Cropland | 1) Flower strips; 2) Hedgerows | 1) No flower strips; 2) No Hedgerows | Metric: Crop pollination service; Effect size: Fisher's Z-transformed r | 62.5 |

Results

- Crop pollination effects were more variable across studies and overall not significantly different between crops with or without adjacent floral planting across all studies and within-field distances.

Factors influencing effect sizes

- Distance to field edge : Effects of distance to field edge differed for fields with floral plantings compared with control field. Pollination services were increased near floral plantings and decreased exponentially with increasing distance from plantings, while no such effect of distance to field edge was detected for control field.
- Time since treatment : Crop pollination services tended to increase with time since establishment of the adjacent flower strip, but showed a positive saturating relationship. Pollination services increased by 27% in 2 year old strips compared with the youngest plantings (roughly 3 months old), while the additional predicted increase from 2 to 4 years or older strips was approximately 5% on average.
- Flowering plant species richness : Crop pollination services tended to increase with flowering plant species richness of the adjacent flower strip.

Conclusion

This synthesis reveals inconsistent and highly variable effects of flower strips and hedgerows on crop pollination services.