FARMING PRACTICE
LANDSCAPE FEATURES

IMPACT: POLLINATION

Reference 2

Lowe, EB; Groves, R; Gratton, C 2021 Impacts of field-edge flower plantings on pollinator conservation and ecosystem service delivery - A meta-analysis AGRICULTURE ECOSYSTEMS AND ENVIRONMENT, 310, 107290. 10.1016/j.agee.2020.107290

Background and objective

Limited flower availability is believed to be one of the leading causes of bee declines worldwide. Farmers are frequently encouraged to plant herbaceous flowers or flowering hedges along the edges of crop fields as a means of both addressing wild bee declines and attracting wild bees to crop fields for pollination. Despite the increasing popularity of field-edge pollinator plantings, studies on planting effectiveness have shown mixed results. To determine whether field-edge flower plantings 1) increase pollinator abundance or richness within field edges, 2) increase the abundance or richness of pollinators visiting crop flowers, or 3) improve crop yields. Here, the results for objectives 1 and 2 are reported.

Search strategy and selection criteria

The Web of Science Core Collection Database was used to identify studies that evaluated impacts of field-edge plantings on wild pollinators. Specifically, a keyword search which pulls from terms in article titles, abstracts, keywords, and KeyWords Plus was conducted. The search was limited to English language articles and evaluated all records from 1900 through February of 2020. Search terms included: ("planting*" OR "enhancement" OR "hedgerow*" OR "strip" OR "reservoir*" OR "flower border" OR "flower margin*" or "floral border" or "floral margin*" or "sown margin") AND ("pollin*" OR "bee" or "bees" OR "bombus" OR "apidae"). Additional citations were identified via ad-hoc searches of studies referenced in highly-cited papers and through the "view related records" tool in Web of Science, which generates a list of papers that share citations with a selected paper. Studies that 1) report data, are peer-reviewed, include a field experiment, and compare planted edges to a control area that was not planted; 2) report a response variable relevant to wild bees. Some studies focused on broader pollinator communities rather than just wild bees. These were accepted as long as they included wild bees in their pollinator surveys (10 studies); 3) include a minimum sample size of 3 replicates in both the treatment and control group; provide a spatial replicate (i.e. single-site block designs were excluded); and report mean, sample size, and a measure of variance (standard deviation, standard error, standard error of the mean, confidence interval, or interquartile range), in the text, tables, or figures. Any articles that did not evaluate the effects of intentionally planted field-edge flowers on pollinators within an agricultural context were excluded from further review.

Data and analysis

All meta-analyses we conducted using random effects models fit with REML in the metafor package in R. Before performing these analyses, the normality of effect size estimates was assessed, and publication bias and heterogeneity evaluated. Separate meta-regressions were run to examine how planting size, flower richness, and maturity influence bee responses and crop yield. To account for the non-independence of within-study effect sizes, multi-level meta-regressions that included a random term for study were run.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
29	Arable crops, vegetables and orchards in Europe, America, New Zealand and South Africa	Field-edge flower plantings	Unplanted, unmanaged field edges; unplanted, managed field edges (e.g., herbicide or mowing); grass strips; bare ground; and crop fields with no edge	Metric: Pollinator abundance and richness in the field-edge flower plantings; Pollinator abundance and richness in the crops; Effect size: Hedge g (standardized difference) comparing the considered metrics between intervention and control	87.5

Results

- Pollinator plantings had strong and significant positive effects on overall pollinator abundance ($k = 29$, $p < 0.001$) and richness ($k = 20$, $p < 0.001$) in field edges adjacent to crops.
- Pollinator plantings did not signficantly alter overall pollinator abundance ($k = 12$, $p = 0.44$) or richness ($k = 6$, $p = 0.94$) in crop fields.

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

Results suggest that field-edge flower plantings are highly effective at increasing pollinator richness and abundance in field edges and that plantings become more effective as they mature. However, the influence of field-edge plantings on crop pollination is inconsistent.