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Zamorano, J; Bartomeus, I; Grez, AA; Garibaldi, LA 2020 Field margin floral enhancements increase pollinator diversity at the field edge but show no consistent spillover into the crop field: a meta-analysis *INSECT CONSERVATION AND DIVERSITY*, 13, 519-531. 10.1111/icad.12454

Background and objective

Conventional intensification of agriculture has reduced the availability of resources for pollinators, reducing their diversity and affecting plant pollination, both in natural habitats and croplands. Field margin floral enhancements such as flower strips or restored field margins could counteract these negative effects. The objective of the study is to perform a meta-analysis to understand the influence of field margin floral enhancements on the abundance and richness of pollinators at the edge and within the field, and on crop yield.

Search strategy and selection criteria

A search of the published literature on the effect of field margin floral enhancements on pollinators was conducted using the Web of Science core collection database available from 1975 to May 2019. The following combination was used: *pollinat** AND *hedgerow* AND *crop*, *pollinat** AND *field margin* AND *crop*, *pollinat** AND *hedgerow* AND *agro*, *pollinat* AND *field margin* AND *agro*, *pollinat* AND *edge* AND *crop*, *pollinat** AND *edge* AND *agro*, *pollinat* AND *flower strip* AND *crop*, *pollinat** AND *flower strip* AND *agro**. Additionally, a search was made in the database of two other synthesis papers which include 71 and 204 studies, respectively. 1) A field study that evaluates the effect of field margin floral enhancements on the pollinator diversity on the edge or within the crop; 2) The response variables consider the abundance, richness, visitation rate of pollinators, and/or crop yield; 3) Mean, standard deviation (or standard error) and sample size are reported; 4) Includes a comparison between an experimental and a control group. Treatments compare always sites with field margin floral enhancement (experimental group) and sites without field margin floral enhancement (control group).

Data and analysis

Due to the low number of studies on the effect of flower field margins (only restored edges and herbaceous plants) on crop yield, a random-effect model was carried out. For pollinators, a mixed-effects model was carried out using edge management, edge type and pollinator guild as moderators of the effect. Analyses were run independently for each type of contrast (i.e. edge–edge, edge–interior and interior–interior) and the effect size was estimated for the different levels within each moderator. The models were adjusted using the estimate of maximum restricted likelihood. The heterogeneity of the effect sizes between the levels of each moderator was tested using omnibus (QM) tests. Publication bias was tested using funnel plots.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
40	Croplands and grasslands	Sites with field margin floral enhancement	Sites without field margin floral enhancement	Metric: Abundance and richness of pollinators; Effect size: Hedge g (standardized difference) comparing the considered metrics between intervention and control	81.25

Results

- There was a clear overall positive estimated effect size of field margin floral enhancements for both abundance and richness of pollinators in the edge of treatment sites, compared to control sites. Restored edges and with the presence of herbaceous plants are those that present the greatest abundance and richness of pollinators on the edge, mainly for hoverflies (abundance–richness) and wild bees (richness).
- The estimated effect size of field margin floral enhancements is not significant regarding abundance or richness of pollinators within the crop.
- There was no effect of field margin floral enhancements on pollinator visit rate.

Factors influencing effect sizes

- Field edge management : Arboreal field margins had no effect on biodiversity at the edge of the crop.
- Field edge vegetation type : Shrubs field margins had no effect on biodiversity at the edge of the crop.
- Pollinator species : The impact of field margins was higher for hoverflies than for wildbees.

Conclusion

Overall, the field margin floral enhancements increased the abundance and richness of pollinators at the field edge but had no consistent effect in the interior of the crop fields.