FARMING PRACTICE INTERCROPPING

IMPACT: PESTS AND DISEASES

Reference 24

Letourneau, DK; Armbrecht, I; Rivera, BS; Lerma, JM; Carmona, EJ; Daza, MC; Escobar, S; Galindo, V; Gutierrez, C; Lopez, SD; Mejia, JL; Rangel, AMA; Rangel, JH; Rivera, L; Saavedra, CA; Torres, AM; Trujillo, AR 2011 Does plant diversity benefit agroecosystems? A synthetic review Ecol. Appl. 21, 9-21. 10.1890/09-2026.1

Background and objective

Predictive theory on how plant diversity promotes herbivore suppression through movement patterns, host associations, and predation promises a potential alternative to pesticide-intensive monoculture crop production Do specific types of diversification schemes designed for associational resistance to herbivores, attraction of natural enemies, or moving herbivores away from crops have the predicted effects? Do more diverse cropping schemes in general have an overall negative effect on herbivores, a positive effect on natural enemies, reduce crop damage and increase crop yield?

Search strategy and selection criteria

Authors reviewed the 62 publications selected by Poveda et al. (Poveda, Katja, María Isabel Gómez, and Eliana Martinez. "Diversification practices: their effect on pest regulation and production." Revista Colombiana de Entomologia 34.2 (2008): 131-144.) from their initial 279 articles published between 1998 and 2008 addressing insect pests, biological control, and plant diversification in agroecosystems. Poveda et al. (2008)'s criteria for selecting these 62 articles were that the articles were available and reported field experiments on vegetation diversification within or surrounding crop fields, implemented simultaneously. with the crop production cycle. Authors' additional criteria for the meta-analysis were that: (1) plant species richness was quantified, described, or manipulated in a way that could be construed as a relatively species-poor vs. species-rich condition for crop production and (2) researchers reported or were able to provide us with means for arthropod herbivore response variables (abundance of natural enemies, herbivore abundance, herbivore mortality caused by natural enemies, crop damage by herbivores, and/or crop yield), variance around the means, and numbers of replicates. Because most of the articles provided multiple experiments involving different herbivores and/or different natural enemy manipulations at different locations or in different years, our general approach was to include only tests that could not be logically dropped from the analysis. However, authors excluded experiments that were confounded by differential insecticide applications on plant diversity treatments or that used planting densities that were deemed by the authors to be impractical for effective crop production.

Data and analysis

To calculate the effect as a proportional change in plant species diversity, authors used bias-corrected Hedges' d to calculate the overall treatment effect size (dþ). Authors did not include the precision of each study's estimates in this analysis (i.e., variance weighting). Differences in effect sizes were calculated using mixed effects models performed with MetaWin 2.0 statistical software. Authors used the bootstrap confidence intervals because resampling methods are appropriate when data are not normally distributed; Authors standardized effect sizes on the extreme ends of the distribution did not all fall within a normal distribution.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
45	Multiple crops	Intercropping	Monoculture	Metric: 1) Pest Arthropod herbivore abundance; 2) natural enemy abundance; 3) crop damage; Effect size: Hedge d (standardized difference) comparing the considered metrics between intervention and control	87.5

Results

- Intercropping schemes were effective at decreasing herbivore abundance significantly.
- Intercropping schemes were effective at increasing natural enemy abundance significantly.
- Intercropping schemes were effective at decreasing crop damage significantly.

Factors influencing effect sizes

- No factors influencing effect sizes to report.

Conclusion

Overall, herbivore suppression, enemy enhancement, and crop damage suppression effects were significantly stronger on diversified crops than on crops with none or fewer associated plant species.