Landscape Diversity and Lady Beetles in Southern Wisconsin

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Abstract

This research was conducted in order to add information on the topic of biological control in agriculture. The percentage of seminatural land within 2 km of agricultural fields was studied in relation to the number of lady beetles found in these fields. It was hypothesized that as seminatural land increased, lady beetles would follow. The land area and numbers of lady beetles collected were compared using linear regression and Spearman's Rank tests and the data was found to be statistically significant. The biological control provided by these lady beetles could reduce the number of pesticides needed in farms, benefiting the environment and human health.

Introduction

- Pesticides cause diseases in humans who eat and handle pesticide-treated agriculture and kill important species for biological control.
- Biological control can replace pesticides and restore ecosystems, instead of using natural predators to control pest populations in agriculture.
- Lady beetles are extremely effective biological control agents.
- Diverse landscapes support the lady beetle life cycle and increase the population in the surrounding area (Wang, 2020). They travel from these landscapes to agricultural fields for predation.
- We hypothesized that as the percentage of natural land within 2 km of corn and soybean fields increased, the average number of lady beetles collected within these fields would as well because of the benefit seminatural landscape has on lady beetle populations.

Methods

Sticky cards were placed in 51 corn and 31 soybean fields across Southern Wisconsin in six rounds throughout the summer, for three weeks per round to allow insects to accumulate on the cards. The cards were frozen for analysis and the amount of lady beetles on each card was counted and recorded by species and location.

The USDA cropland data layer (CDL) was used to determine the ratio of seminatural land within 2 km of each field. The CDL was color-coded by land category. This was extracted and seminatural land was isolated for our study.

The average number of lady beetles per field that prey on aphids was compared to the percentage of seminatural land around the field using linear regression and Spearman's Rank tests to determine if a correlation was statistically significant.

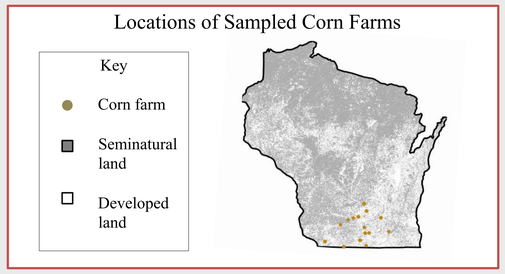

Figure 1. Locations of Corn Farms Sampled shows the locations across Wisconsin of the farms containing corn fields used in the study and demonstrates the ratio of seminatural land surrounding them.

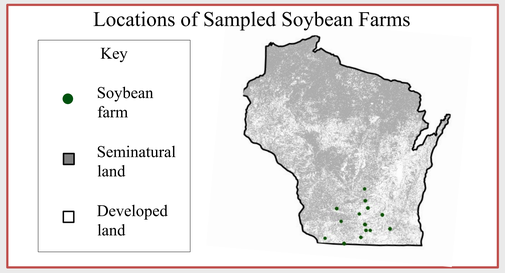

Figure 2. Location of Soybean Farms sampled shows the locations across Wisconsin of the farms containing soybean fields used in the study and demonstrates the ratio of seminatural land surrounding them.

Results

- Both corn and soybeans had a clump of data with low numbers of lady beetles collected and small percentage of seminatural land within 2 km.
- Lady beetle counts in corn had an outlier with an average of 4.25 lady beetles collected and 34% natural land while soybeans had an outlier with an average of 4.5 ladybeetles collected and only 16% natural land.
- The number of lady beetles collected in corn fields had a significant positive correlation ($p=0.042$, $R^2=0.0799$, $r=0.297$) with the increase in percentage of seminatural land.
- The number of lady beetles collected in soybean fields had a significant positive correlation ($p=0.017$, $R^2=0.2717$, $r=0.426$) with the increase in percentage of seminatural land similarly to corn

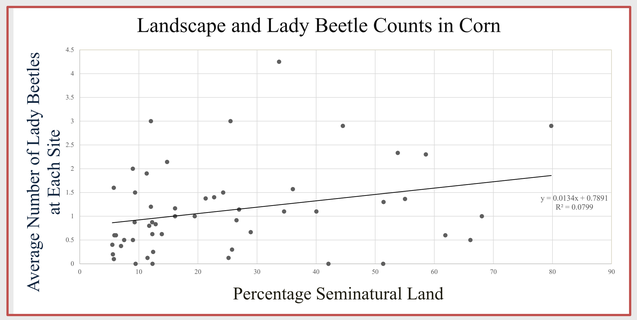

Figure 3. Landscape and Lady Beetle Counts in Corn shows the linear correlation and regression between percentage of seminatural land and the average number of lady beetles in corn fields.

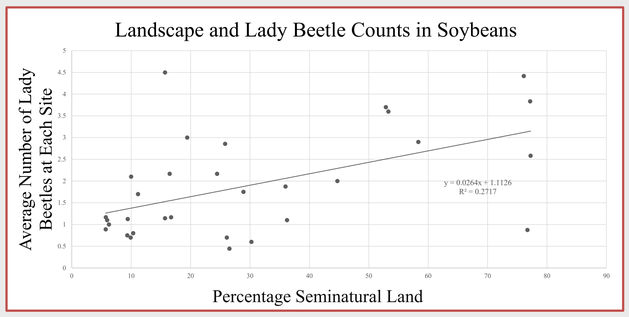

Figure 4. Landscape and Lady Beetle Counts in Soybeans shows the linear correlation and regression between the percentage of seminatural land and the average number of lady beetles in soybean fields.

Discussion

- The Spearman's Rank Tests determined a positive Spearman's Rho (ρ) for both corn and soybeans, indicating that there is a positive correlation between the variables studied.
- Because the p values were less than 0.05 (0.042 for corn and 0.017 for soybeans), the correlation between the variables is statistically significant, supporting our hypothesis.
- The trendline for corn (y=0.0134x+0.7891) had approximately half the slope than that of soybeans (y=0.0264+1.1126), but this could have been due to confounding variables.
- The results of this study show that seminatural land supports lady beetles and increases their ability to perform as biological control agents in agricultural fields. This is supported by prior research stating that non-crop plants support the lady beetle life cycle (Wang, 2020).
- In the future, it would be important to only sample from organic farms in order to remove the variable that previous pest control methods present. Also, the category of seminatural land should be refined to represent the different classifications within it (forests, grasslands, etc.) in order to determine their individual effects.
- If further researched, biological control could revolutionize modern agriculture, benefit human health, and restore ecosystems damaged by pesticides.

Acknowledgments

I would like to gratefully acknowledge the help and support of Ben Iuliano both in and out of the lab. Without him and the opportunities he has provided, this study would not have been possible. I would also like to thank Mike Smale for his helpful feedback and guidance throughout this project.

References

Wang, Yusha, et al. "Effects of Four Non-Crop Plants on Life Histpry Traits of the Lady Beetle Harmonia Axyridis." *Entomologia Generalis,* vol. 40, no. 3, Nov. 202, pp. 243-52. DOI.org (*Crossref*), https://doi.org/10.1127/entomologia/2020/0933.