CAN BUFFER ZONES ENHANCED WITH NATIVE WILDFLOWERS PROVIDE NATURAL PEST MANAGEMENT?

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Background

- Industrial agriculture methods involve using large amounts of organophosphate (OP), carbamates and pyrethroids to deter unfavorable insects, weeds, and fungi that harms agricultural productivity. However, these chemicals can reach surface water through runoff, contaminate ground water, decrease soil fertility and quality, and can pollute the air and harm non-target vegetation (Aktar, Sengupta & Chowdhury, 2009).
- Vegetative buffers are a solution to mitigate soil erosion and movement of chemical run-off. The complex root zones of vegetative buffers have high concentrations in microorganisms and soil organic matter that absorb chemical run-off. Vegetative buffers also provide a habitat for native pollinators and other insects (Hoekstra & Hannam).). By enhancing vegetative buffer zones with native wildflower species that attract beneficial insects such as hoverflies while also absorbing large amounts of pesticide run-off, wildflower-enhanced buffer zones may decrease dependency on synthetic pesticides that deter crop pests such as aphids (Pekas et, al.)

Figure 1. A visual representation of what an enhanced wildflower buffer zone looks like. Wildflowers attract insects that are beneficial to the environment and help repel and deter enemy pests from field crop. Photos from Iowa State University and Minnesota Press.

Motivation

- Organic farms are the only agriculture-type that is required to have buffer zones (USDA Organic Regulations), and there are no regulations requiring industrial agriculture plots to have buffer zones, but incentive programs organized by the Conservation Reserves Enhancement Program (US Department of Agriculture). Buffer zones can also be enhanced with the addition of native wildflower species that attract insects that help deter enemy pests (Gill, Cox & O'Neal). Installing vegetative buffer zones with the addition of native wildflower species has the potential to increase beneficial insect species that help deter pests harmful to crops (Albrecht et al).
- **I propose to evaluate how insect species native to wildflowers in vegetative buffers can help manage enemy crop pests, focusing on how hoverflies decrease aphid infestations.**

Hypothesis

- I hypothesize that there is a relationship between wildflower-enhanced buffer zones and natural pest management.

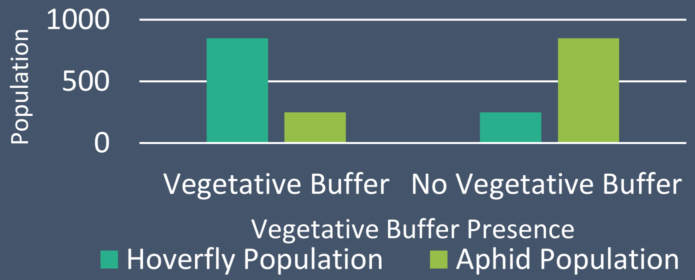

Figure 2. My predictions about how vegetative buffers supplemented with wildflowers will influence Hoverfly and Aphid populations. Population will be measured using an average population number per square feet that will be adjusted to account for square footage of plots. Data numbers are based off "One stone; two birds" article (Pekas et, al)

Predictions

- I predict that Hoverfly populations will be higher in the presence of vegetative buffer zones with wildflower supplementation, and lowest without vegetative buffer strips where Aphid populations will be higher (Figure 2).
- I also predict that increased Hoverfly population supported by vegetative buffer strips indicate other insects that may help reduce enemy pest populations.

Study Design

- I will conduct a field experiment at a series of different agricultural plots where there are no vegetative buffers, vegetative buffers, and wildflower supplemented vegetative buffer zones to investigate the efficacy of buffer zones and their effectiveness in deterring crop enemy pests. (Figure 3).
- The control, or independent variable will be the plot without any vegetative buffers to establish what the natural patterns of insect presence is. This will establish the baseline population for Aphid populations.
- The dependent variables will be the plots with vegetative buffers and vegetative buffers with supplementary wildflower plants. (Figure 3).

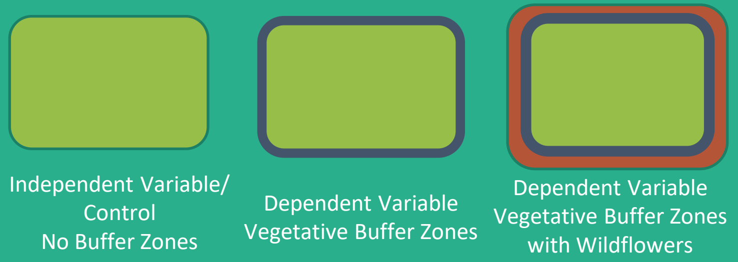

Figure 3. Visual portrayal of the three different types of plots to be evaluated as a part of studying the efficacy of vegetative buffers and wildflower presence in promoting insect species that repel enemy pests

Study Design cont.

- The data will be collected by counting the number of Hoverflies and Aphids present within a series of square footage of the respective plots; no buffer zones, vegetative buffer zones, and vegetative buffer zones with wildflowers present. The numbers for each plot will be averaged then multiplied to reach the approximate number of Hoverflies or Aphids present in each plot.

Intended Analysis

- Given that the independent variable (treatment: no buffer, vegetative buffer, and vegetative buffer with wildflowers) is categorical with >2 groups, and the dependent variable (number of beneficial insects and enemy pests present) is continuous, the data results will be analyzed using the Analysis of Variance Analysis (ANOVA).
- The ANOVA test will be used to determine whether there are any statistically significant differences between the data of three or more groups. More specifically, ANOVA will help determine if there is a vegetative buffer-related difference, or a vegetative buffer with wildflower-difference between the two treatment types.

Expected Benefits

- The use of pesticides has drastically decreased the amount of enemy pests in agriculture plots. However, because many of these synthetic pesticides do not target just one species of insects, they have severe implications for even beneficial insects. By restoring prairie wildflowers in vegetative buffers, the dependency on synthetic pesticides may lessen, and can support beneficial insects such as Hoverflies.

Literature Cited: Aktar, M. W., Sengupta, D., & Chowdhury, A. (2009). Impact of pesticides use in agriculture: their benefits and hazards. *Interdisciplinary toxicology,* 2(1), 1–12. https://doi.org/10.2478/v10102-009-0001-7 , Albrecht, M., et al. (2020). The effectiveness of flower strips and hedgerows on pest control, pollinations services and crop yield: a quantitative synthesis. *Ecology Letters*, Volume 23, Issue 10. https://doi-org.ezproxy.uvm.edu/10.1111/ele.13576 , Gill, K. A., Cox, R., & O'Neal, M. E. (2014). Quality Over Quantity: Buffer Strips Can be Improved With Select Native Plant Species. *Environmental Entomology,* Volume 43, Issue 2, 298-311. https://doi.org/10.1603/EN13027 , Hoekstra, P. M., & Hannam, C. (2017). Vegetative Buffers. *Agriculture and Agri-Food Canada Multi-stakeholder Forum for Neonicotinoids*. https://seedinnovation.ca/wp-content/uploads/2017/11/Vegetative-Buffers-Whitepaper.pdf , Pekas, A., et, al. (2020). One stone; two birds: concurrent pest control and pollination services provided by aphidophagous hoverflies. *Biological Control*, Volume 149, https://doi-org.ezproxy.uvm.edu/10.1016/j.biocontrol.2020.104328 , USDA Organic Regulations. *USDA*. Title 7; Subtitle B; Chapter 1; Subchapter M; Part 205.202. https://www.ecfr.gov/cgi-bin/retrieveECFR?gp=&SID=5376f2e52dfa115b00f46ea7fd635564&mc=true&n=pt7.3.205&r=PART&ty=HTML#se7.3.205_1202 , US Department of Agriculture. Conservation Reserve Enhancement Program. *Farm Service Agency*. https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index