“Catch My Drift?” Effects of Herbicide Drift on Morning Glory Plants and Arthropod Communities

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Introduction

- Agriculture is essential to human food security and economies.
- Crop production is often optimized using herbicides which prevent weeds from outcompeting crops for limited resources.
- One herbicide, dicamba, functions as a synthetic hormone that deregulates weed growth.
- However, dicamba can volatilize post-application (Fig. 1), drift, and affect non-target plants (Fig. 2).
- Dicamba drift to surrounding natural vegetation may affect plant resources available to arthropods, which play a significant ecological role in energy and nutrient cycling.

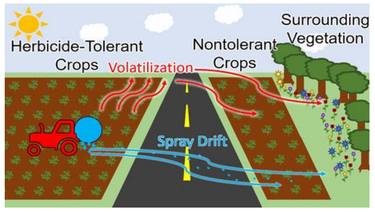


Fig. 1: Herbicide volatilization and drift may spread to non-target crops and surrounding vegetation (1).



Fig. 2: Leaf displaying deregulated growth (“cupping”) from dicamba drift.

Methods

- Experiment was conducted on an agricultural research plot at Matthaei Botanical Gardens in Ann Arbor, Michigan.
- Experimental design consisted of 10 blocks, each with 40 plants split into two treatment groups (Fig. 3). 4 blocks were selected to install pitfall traps, 2 per block.

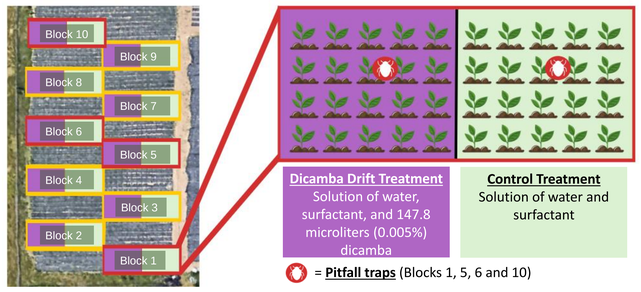


Fig. 3: Experimental design and treatments.



Fig. 4: Prior to treatments, dates of germination (left) and leaf counts (right) were recorded.



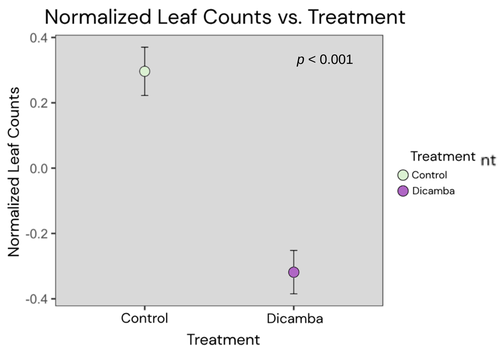


Fig. 5: After treatments, collected data on dicamba damage per plant and arthropod communities. Arthropod community data consisted of visual surveying (left) and pitfall traps (right).

Objective

Explore the effects of dicamba drift on plant growth and their associated arthropod communities using a common agricultural weed, the morning glory (*Ipomoea purpurea*).

Results



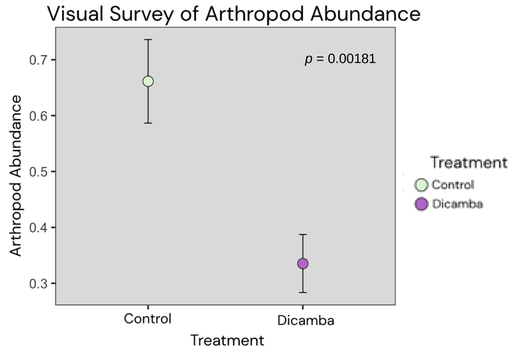
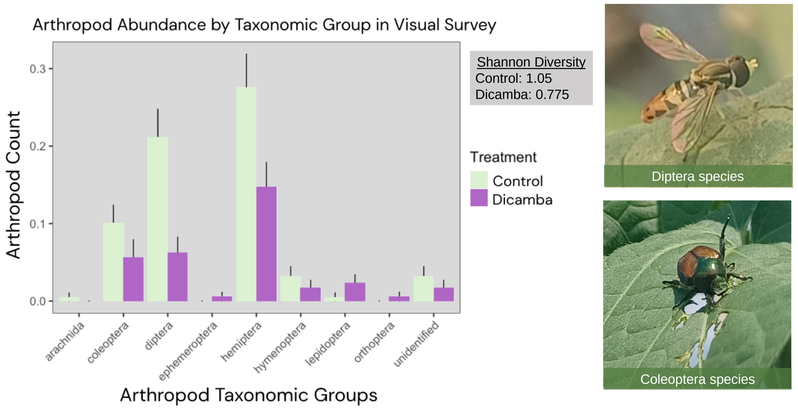


Fig. 6, 7: Plants that received control treatment had significantly greater leaf counts and greater visually observed arthropod abundance than plants treated with dicamba.


Healthy (left) and dicamba-damaged (right) leaves

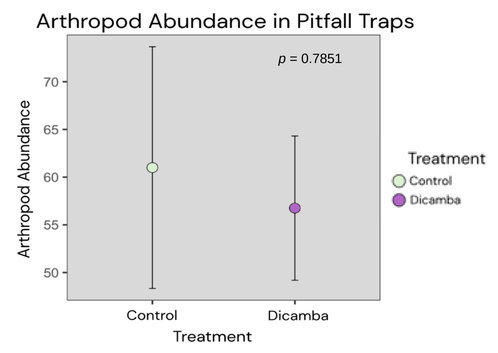

Hemiptera species



Diptera species

Coleoptera species

Fig. 8: Differences in visually observed arthropod abundance were primarily driven by the taxonomic groups Hemiptera, Diptera, and Coleoptera.



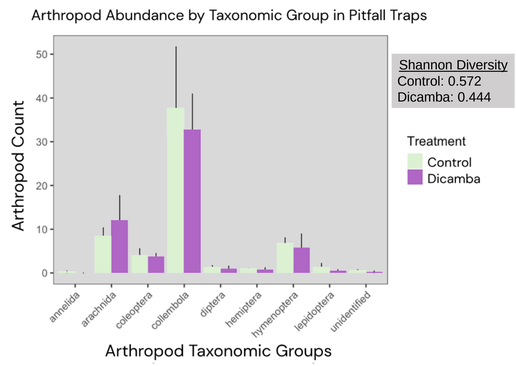


Fig. 9, 10: Results suggest no significant differences in arthropod abundance or diversity between the pitfall traps across treatment groups.

Discussion

- Results show that plants that received the control treatment had higher arthropod abundance and diversity, primarily mediated by differences in leaf counts.
- A longer-term study is needed to assess total arthropod abundance and diversity at various times of day, and throughout the morning glory growing season.
- This information could inform future herbicide chemical formulations and dicamba application practices in the agricultural industry.

Acknowledgements

We thank the University of Michigan Summer Research Opportunity Program for supporting this research, and Matthaei Botanical Gardens Research Coordinator Mike Palmer.

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Reference

1. Sharkey, S. M., Williams, B. J., & Parker, K. M. (2021). Herbicide drift from genetically engineered herbicide-tolerant crops. *Environmental Science & Technology*, *55*(23), 15559–15568. https://doi.org/10.1021/acs.est.1c01906