

Exploring Use of Arbuscular Mycorrhizal Fungi to Facilitate Growth of Lettuce for Community Gardens

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Project Motivation & Goals

1 in 5 Bridgeport Residents!

13.5% (18.0 million) of U.S. households were food insecure at some time during 2023.¹

20.9% of Bridgeport residents are food insecure.²



Lack of food can lead to health problems and developmental issues in children. A lack of nutritious food in particular can lead to issues such as diabetes, heart disease, and obesity to become prevalent in a community.³



Community Gardens can be used as a means of combating food insecurity locally, by providing some level of food independence to communities in need. Increasing the yield of community gardens further develops a community's ability to be food independent.

This project aims to assess the effects of Arbuscular mycorrhizal fungi (AMF) on plant health and growth (Fig. 1), for its application in community gardens to improve yield.

Hypothesis:

If lettuce (*Lactuca sativa*) is grown using soil inoculated with Arbuscular mycorrhizal fungi, then the crop yield will improve because AMF hyphae form around plant roots in soil facilitating nutrient and water uptake by plant (Fig. 1).

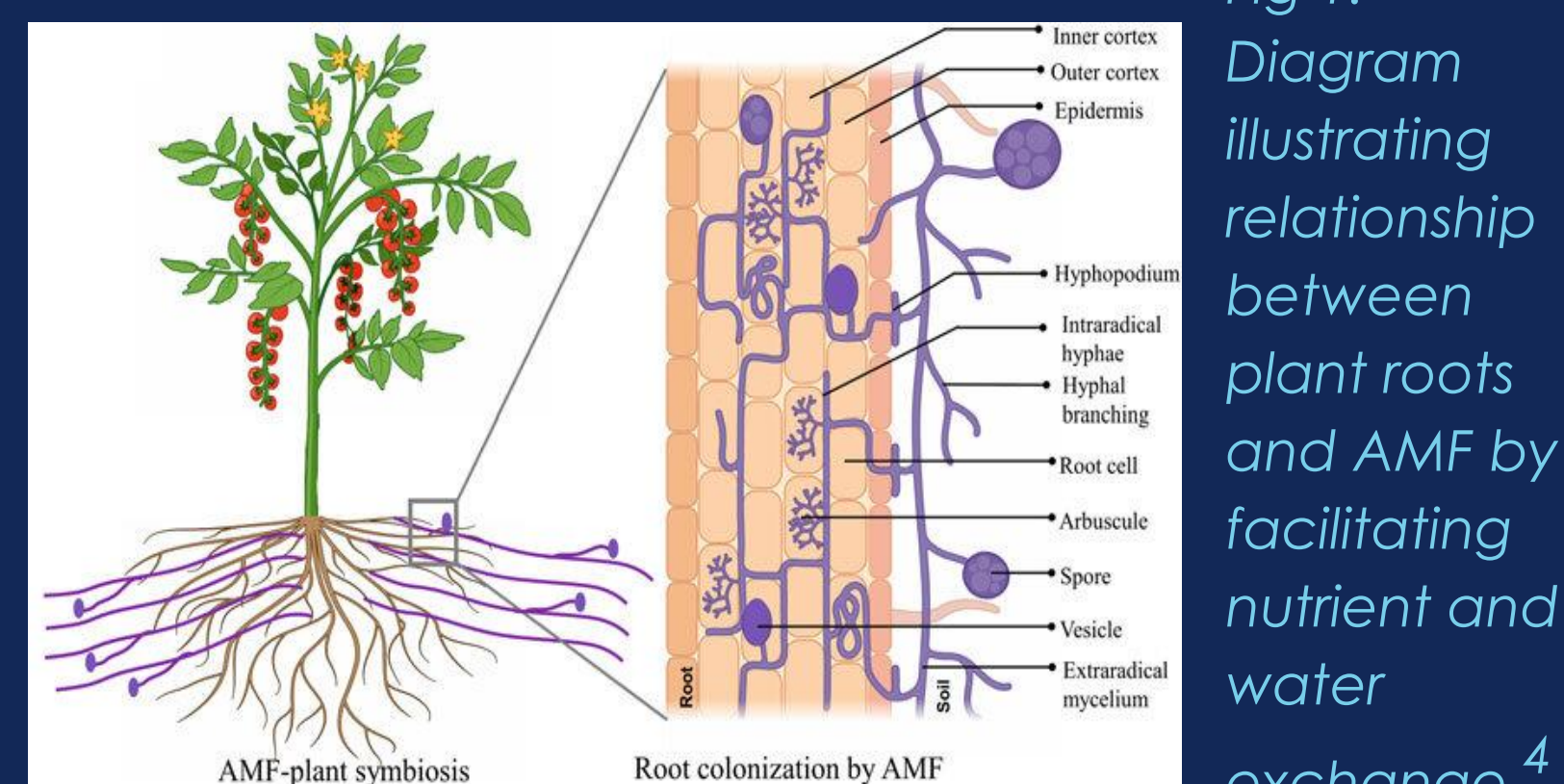


Fig 1. Diagram illustrating relationship between plant roots and AMF by facilitating nutrient and water exchange.⁴

Project Outcomes

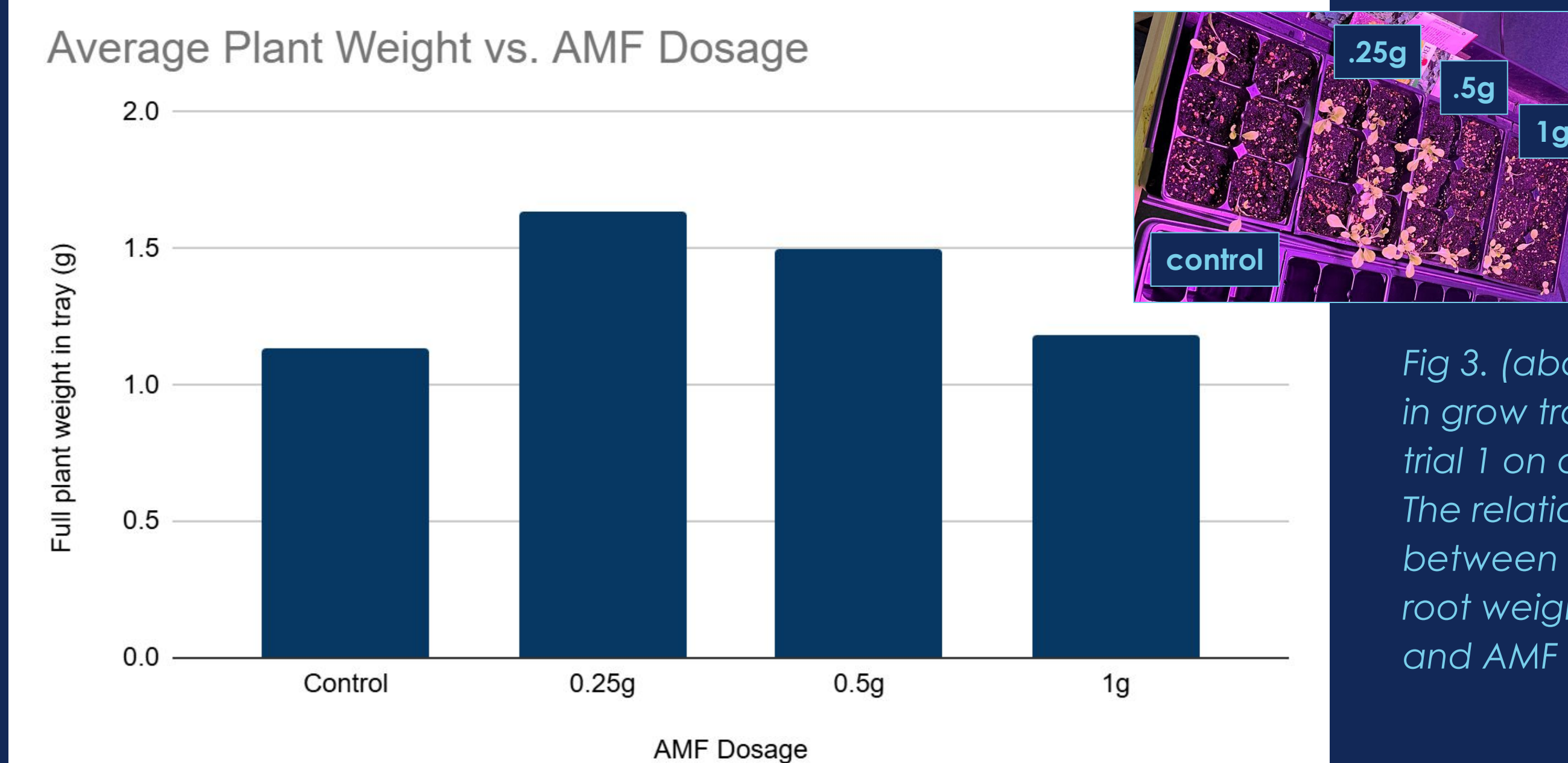


Fig 3. (above) Lettuce in grow trays during trial 1 on day 30. (left) The relationship between average root weight in all trials and AMF dosage.

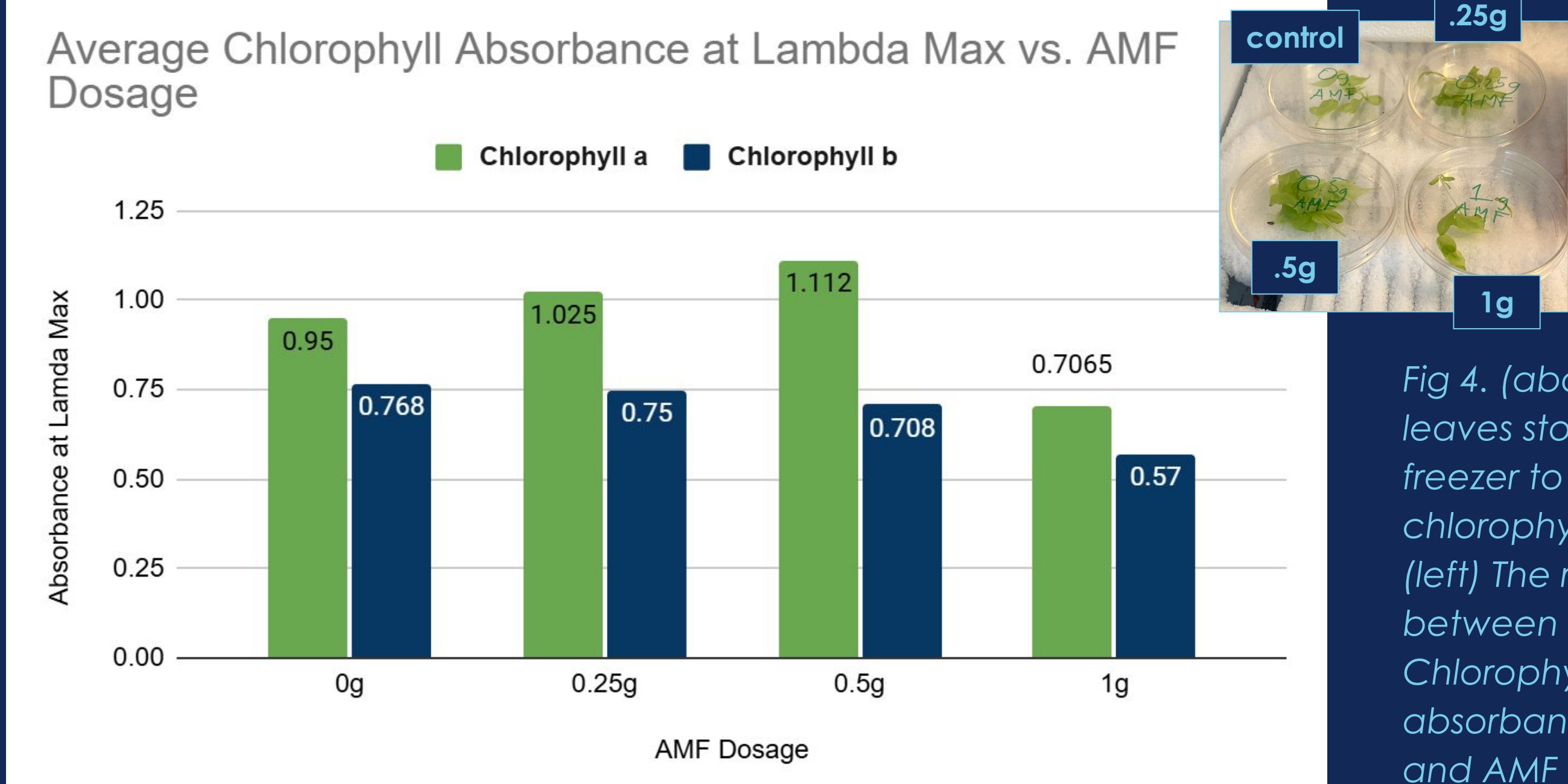


Fig 4. (above) Lettuce leaves stored in freezer to be used for chlorophyll testing. (left) The relationship between average Chlorophyll absorbance in all trials and AMF Dosage.

- Arbuscular mycorrhizal fungi (AMF) was found to have **a significant positive effect on plant weight** (via homoscedastic t-test; p-value of 0.004), as well as the **weight of plant roots** in dosages of **0.25g** and **0.5g** (Fig. 3), indicating that **AMF may lead to a larger harvest and more robust root systems**.
- AMF was found to have a **positive effect on chlorophyll a and b absorbance** in dosages of **0.25g** and **0.5g** (Fig. 4), indicating **enhanced vitality**.
- Lettuce treated with **1g** of AMF were found to have similar results as the control group, indicating that **too high of a dosage can decrease the effectiveness of AMF as a supplement**.
- The dosage of AMF was determined to have **no effect on the taste of the lettuce**, making AMF valid for use in community gardens.
- These findings suggest a **relationship** between enhanced plant development, and the usage of Arbuscular Mycorrhizae in garden soils.
- This research improves scientific understanding of symbiotic fungi and its applications in horticulture.

Conclusion and Next Steps

- Although data suggests a **positive relationship between lettuce growth and certain dosages of AMF**, the findings of this study are inconclusive because only 2 trials were completed.
- Given the effective dosages, it is recommended to use between 1 and 2 grams of AMF per 14 square inches in a raised garden bed.**
- Further, this study was conducted in a controlled environment within a lab. Next potential steps include trailing this experiment in a raised garden bed during the summer growing period.
- While a more expansive study is needed, the results suggest that urban gardeners could consider managing community gardens by inoculating AMF into soils.**
- It is important to note that AMF is only effective with certain plants such as but not limited to soybeans and potatoes,⁵ and should only be used with plants that the relationship is well studied in.
- Other microorganisms, such as rhizobacteria, have been linked to similar results, promoting plant growth and yield.⁶



Acknowledgements and References

I would like to thank the Green Village Initiative and Mr. Osses for their support and guidance, as well as for access to much needed gardening supplies to complete this project. I would also like to thank Julianna Service for providing amazing guidance and mentorship through this entire process. Thank you for NRCA funds to provide project supplies.

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Methods

Preparation:

- The Green Village Initiative (GVI) in Bridgeport supplied grow trays, a fan, grow lights, and seeds required for the experiment (Fig. 2a).
- A grow table was constructed at Bridgeport Aquaculture Center's workshop.
- Grow trays were prepared, and fungi was inoculated into the soil by group (Fig. 2b).
- Each group (6 cells) had a different dose of inoculant, with groups with **0g**, **0.25g**, **0.5g**, and **1g** (Fig. 2b).

Experimentation:

- Lettuce (30 seeds per dose group) were planted and watered with 40 ml of water every other day during the experiment.
- Indicators of plant vitality were recorded, including height (on days 15 and 30); plant and root weight, and chlorophyll a and b (on day 30). (Fig. 2c and 2d)
- 2 trials were completed (each 30 days).
- A homoscedastic t-test was ran to determine that there was a significant relationship between the control and each dosage group.

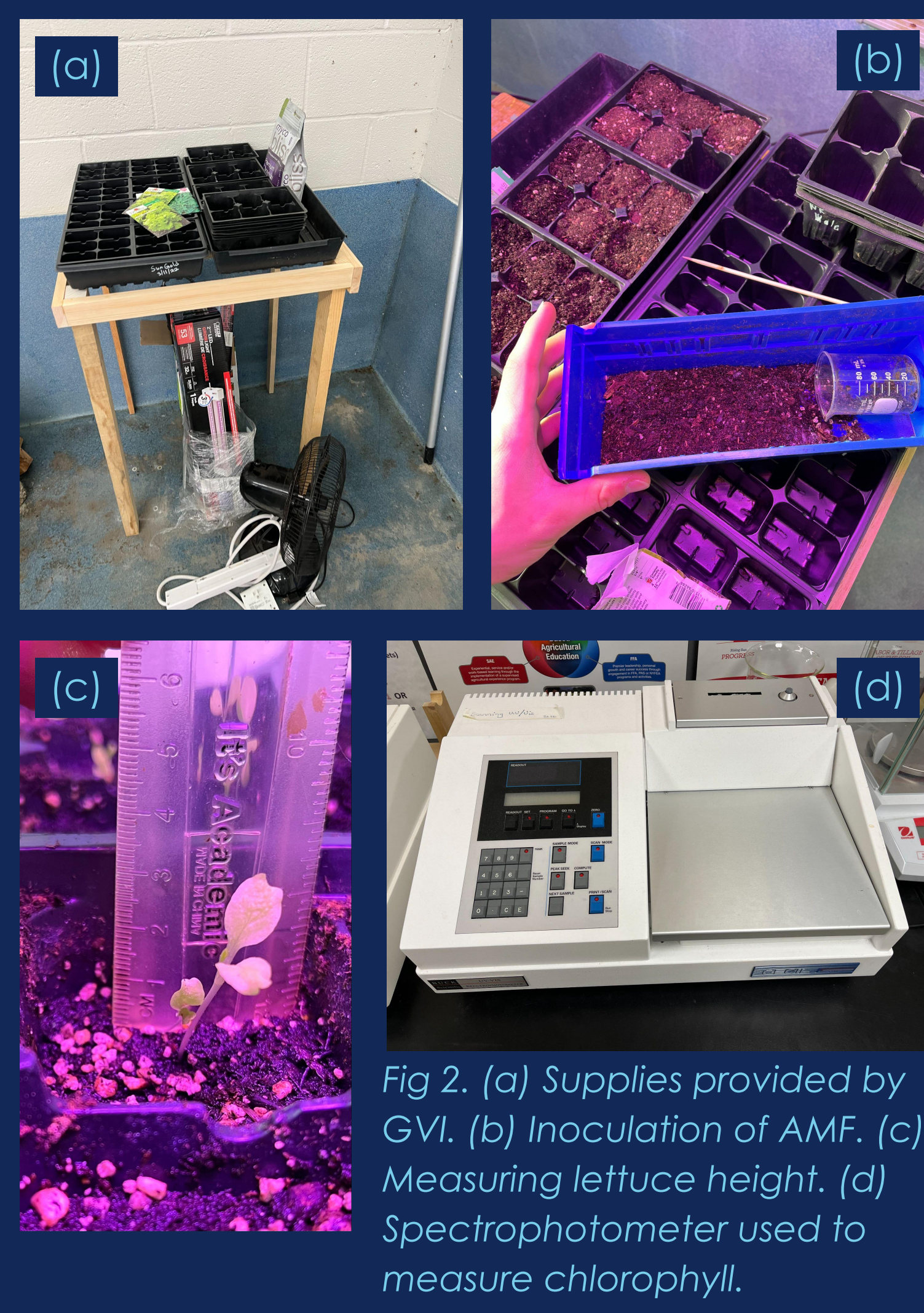


Fig 2. (a) Supplies provided by GVI. (b) Inoculation of AMF. (c) Measuring lettuce height. (d) Spectrophotometer used to measure chlorophyll.

Community Partnership

The Green Village Initiative (GVI; Fig. 5) mission is to "Grow food, knowledge, leadership and community, through urban gardening and farming, to create a more just food system in Bridgeport, Connecticut."

- I worked with Diego Osses, the Managing Director of GVI, to design a sound experimental procedure to analyze the effects of AMF on lettuce.
- Via this partnership, the findings from this study can be used to inform local leaders, workers, and volunteers of ways to improve the output of community gardens, combating food insecurity.
- Experimenting with this fungal supplement in GVI grow-beds would be a great way to observe the effects on yield and food insecurity because of the expertise of GVI staff and their commitment to community outreach.



Fig 5. (left) GVI community and gardens. (right) GVI logo.