



Investigating the Effect of Polyethylene Microplastics on Lettuce Growth

Heena Kraemer, Anahita Khosravi
University of Massachusetts, Amherst



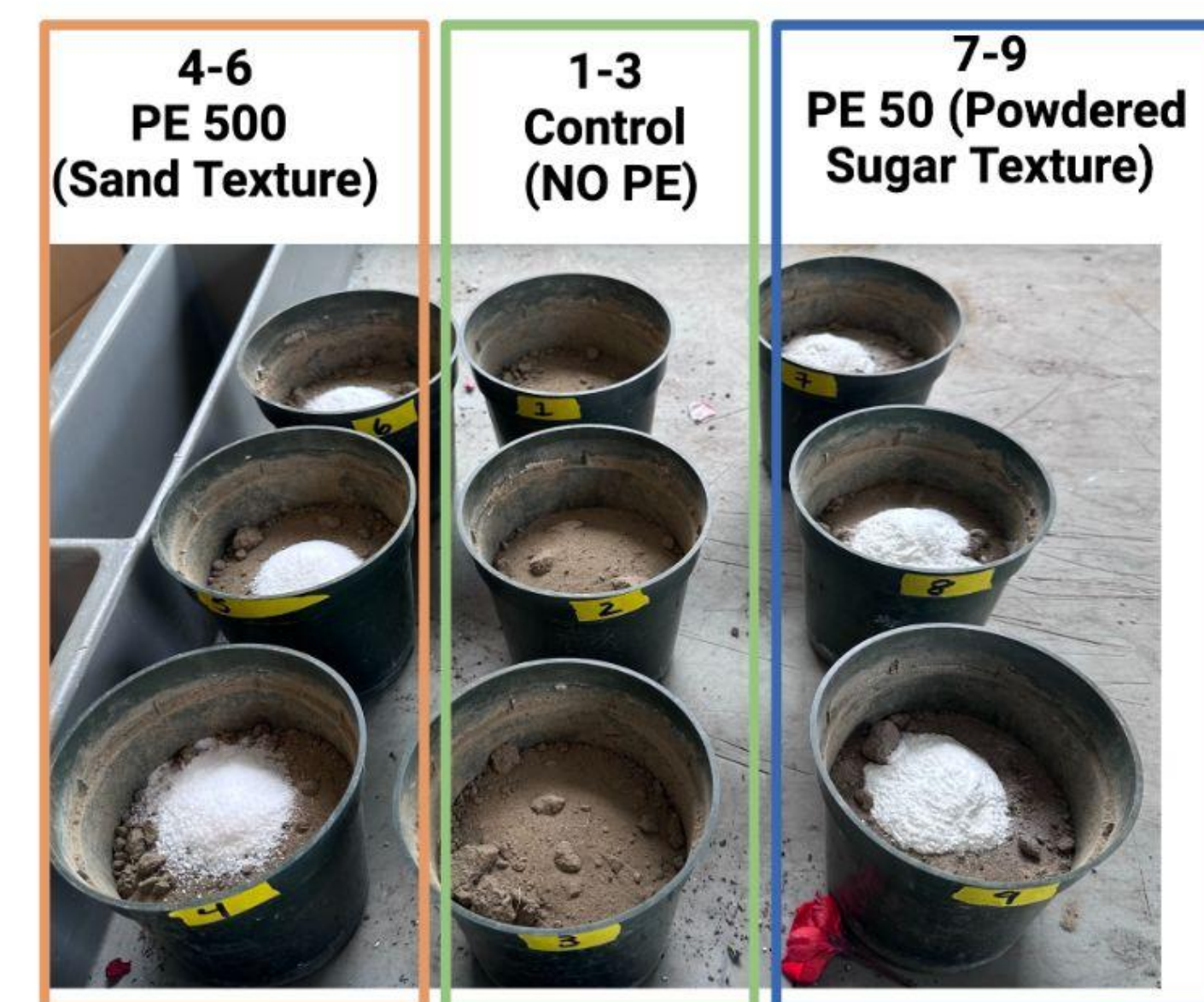
INTRODUCTION



- Plastic use in agriculture has become ubiquitous, ranging from greenhouse covers to plastic mulch use [1]
- Microplastics (MPs) are a pollutant of emerging concern due to their abundance, fragmentation, and its potential to adsorb POPs and heavy metals. [1]
- This study aimed to investigate the effects of the presence of polyethylene MPs of various sizes on the morphology, nutrient content, and hormonal regulation of Romaine Lettuce (*Lactuca sativa*).

Hypothesis: The plants exposed to smaller PE-MPs will show the highest signs of oxidative stress.

METHODS

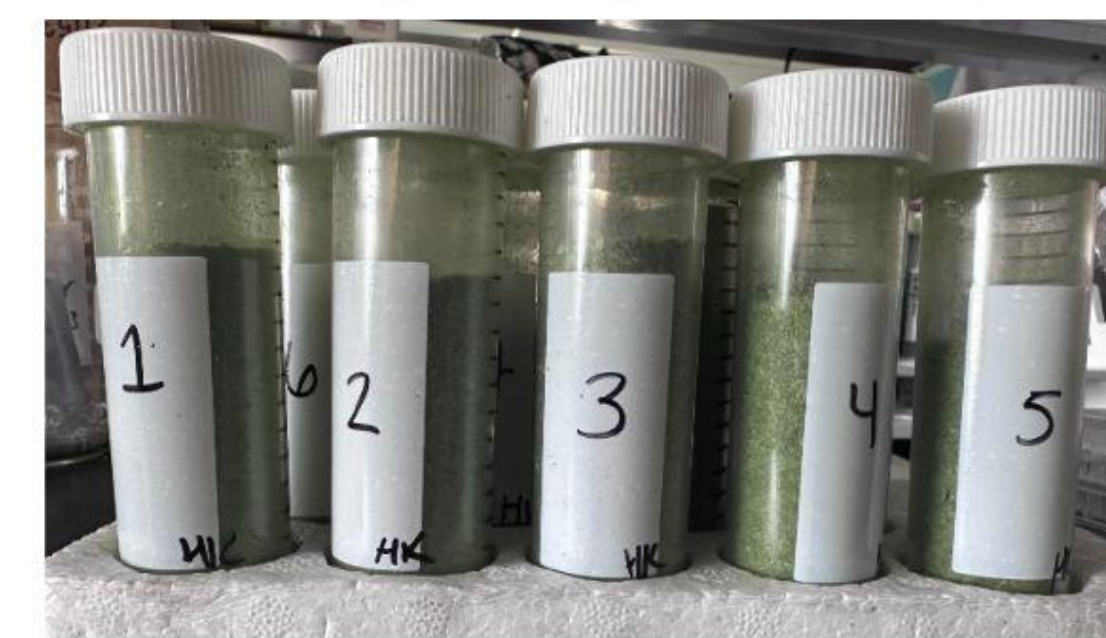


Soil treated with calcium carbonate to reach 6.5 target pH

Allow lettuce to grow for 48 days to reach maturity



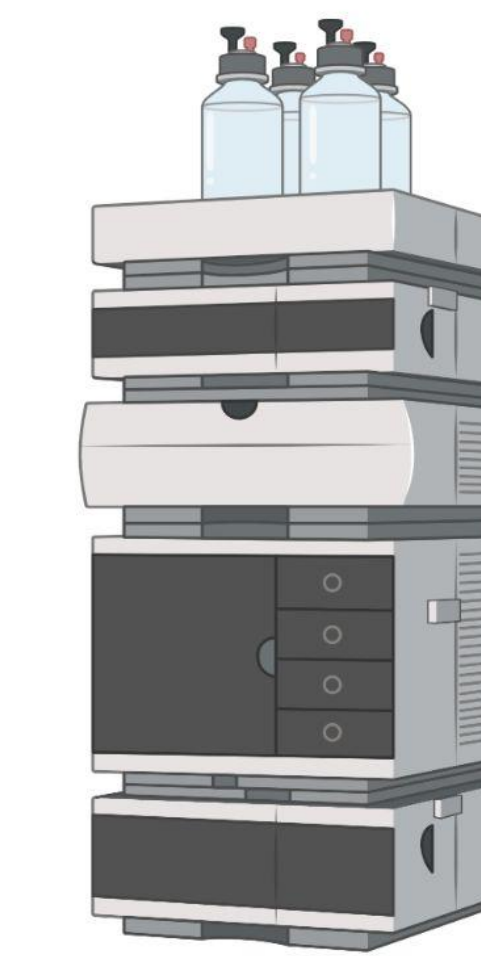
Freeze dry and grind samples



Close up of lyophilized sample after grinding

Larger PE: 500 µm
Smaller PE: 50 µm

Samples were analyzed via HPLC, GC-MS, ICP, and Microplate reader



Salicylic Acid Analysis

Samples were:

- Extracted with 2-propanol/H₂O/HCl (2:1:0.002, v/v/v)
- Partitioned with dichloromethane and concentrated
- Analyzed via HPLC equipped with a UV detector

Single Element Analysis

Samples digested via nitric acid, diluted, and analyzed via ICP

Chlorophyll Content

- Samples were extracted with methanol
- Absorbance at 663 nm and 645 nm measured via EPOCH microplate reader

Lettuce Morphology

- Fresh weight (g)
- Dry weight (g)
- Plant height (cm)
- Leaf Density (# of leaves)

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RESULTS

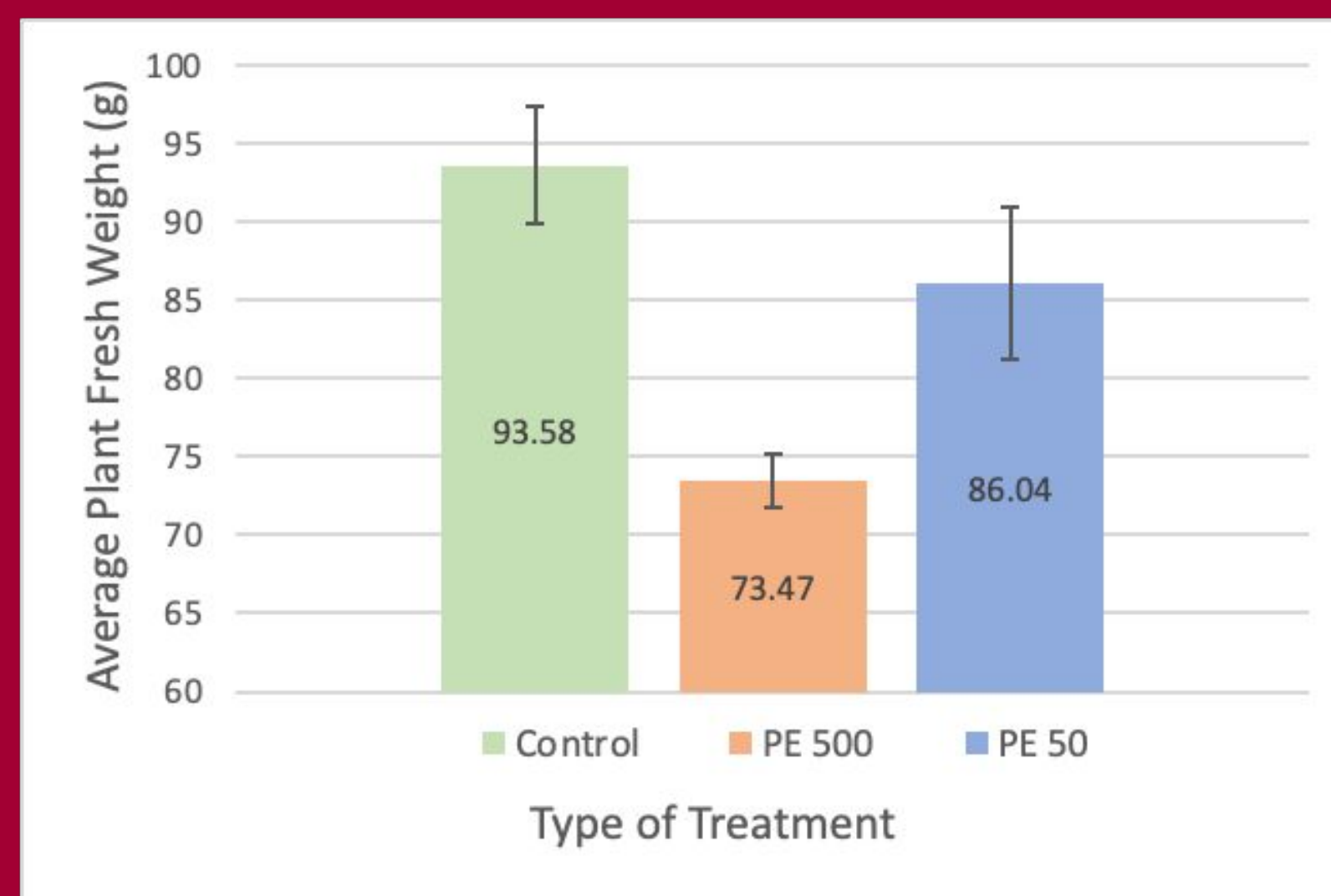


Figure 1: Treatment vs Average Fresh weight (g)

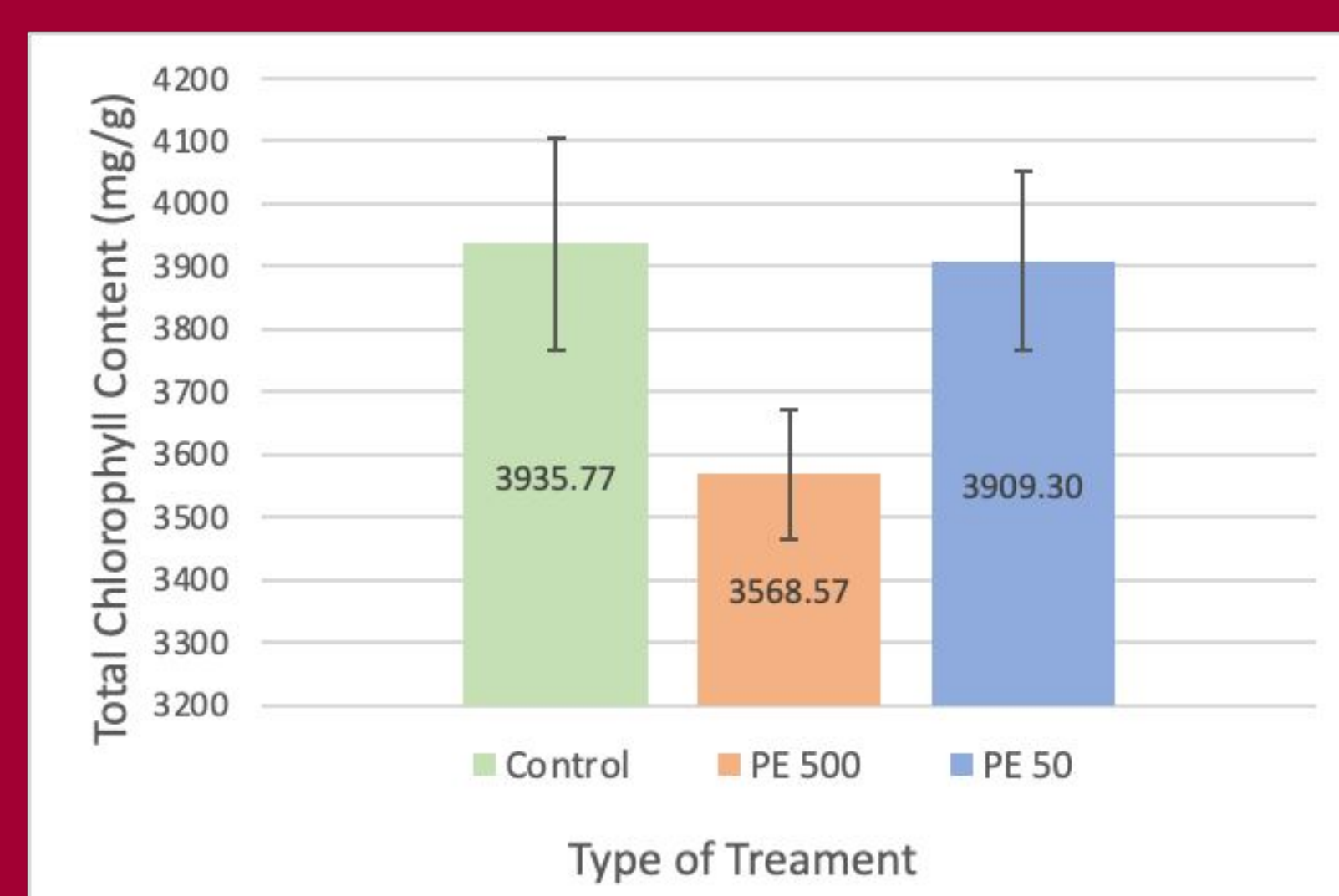


Figure 3: Treatment vs Total Chlorophyll Content

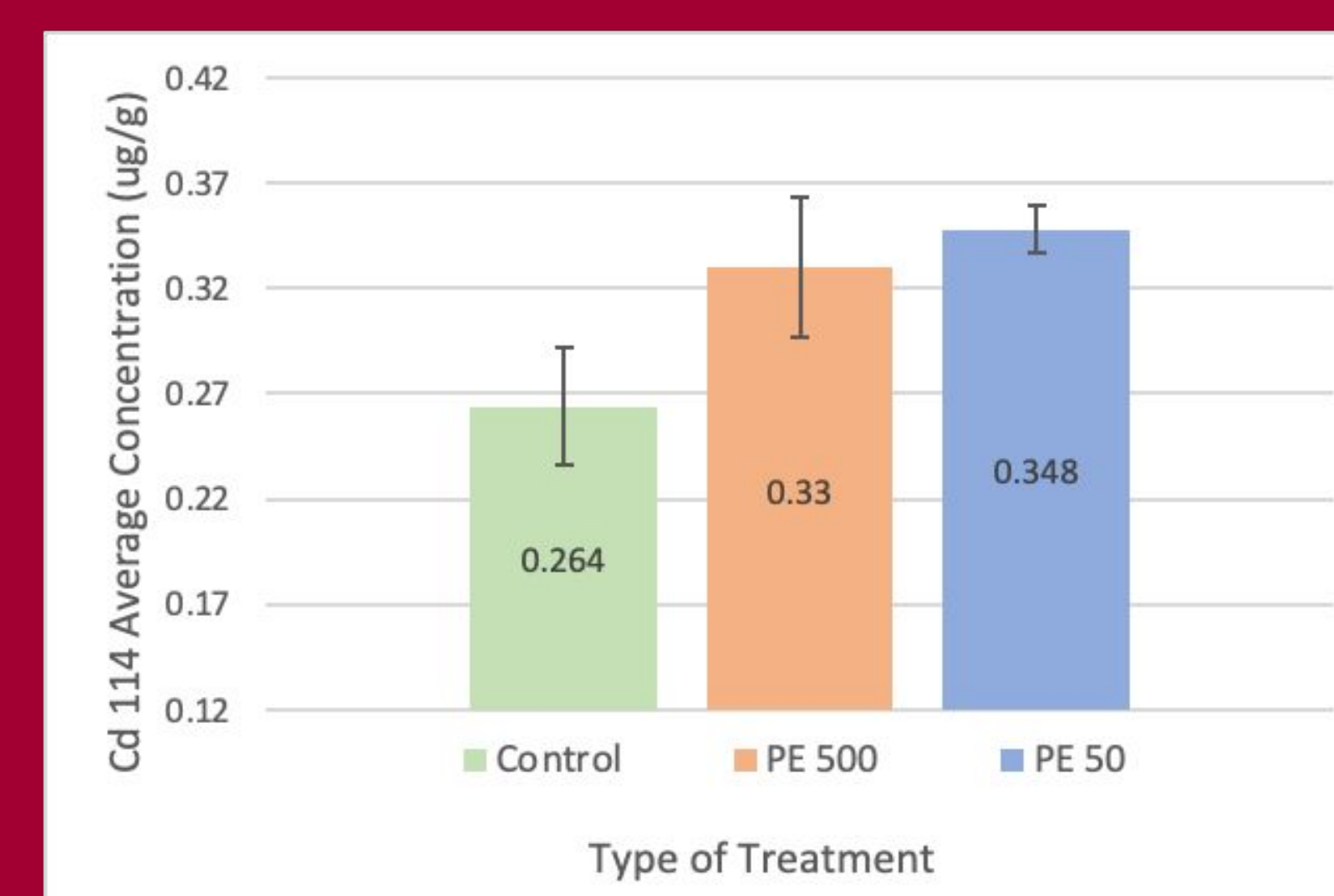


Figure 5: Treatment vs Cadmium Content

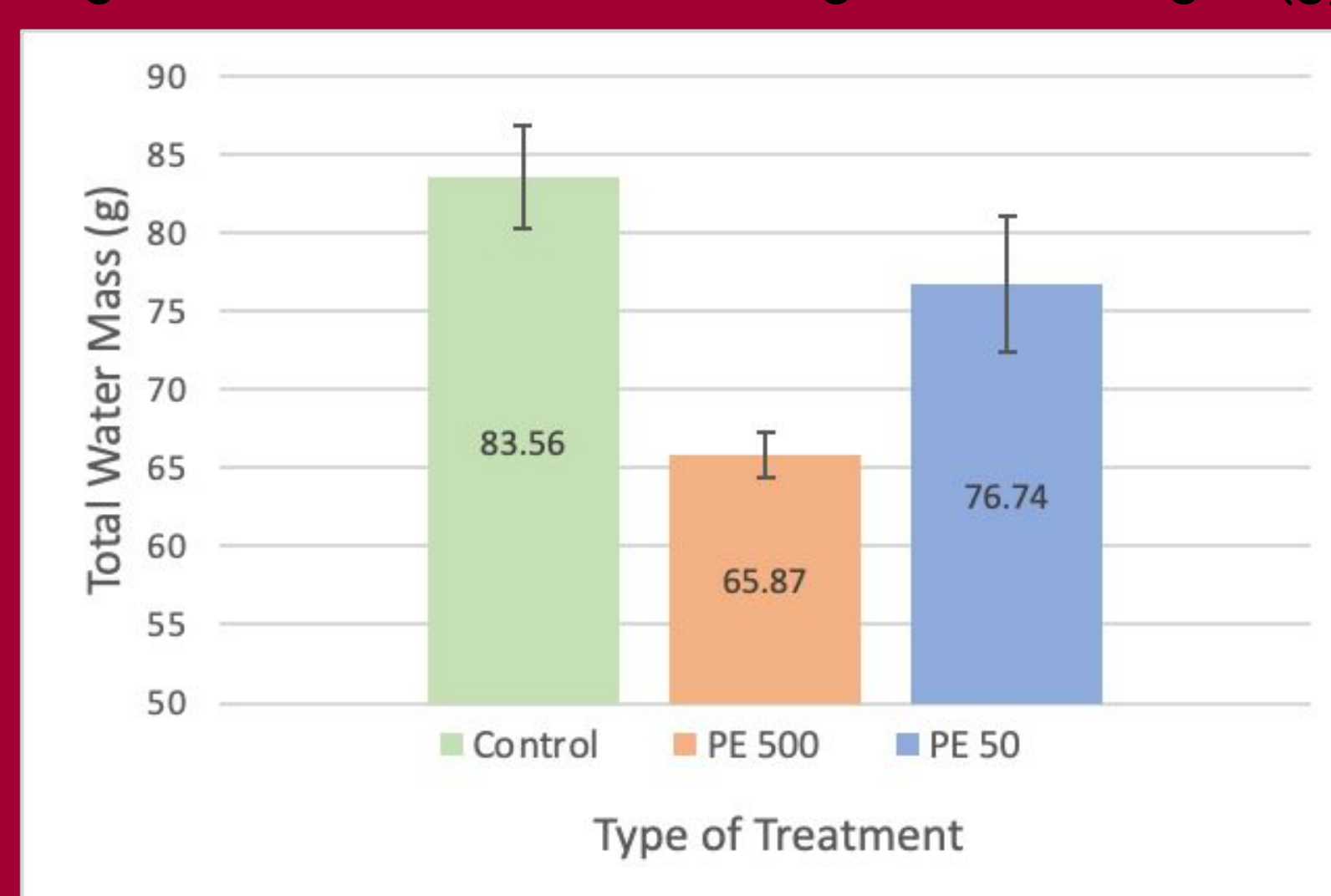


Figure 2: Treatment vs Total Water Mass (g)

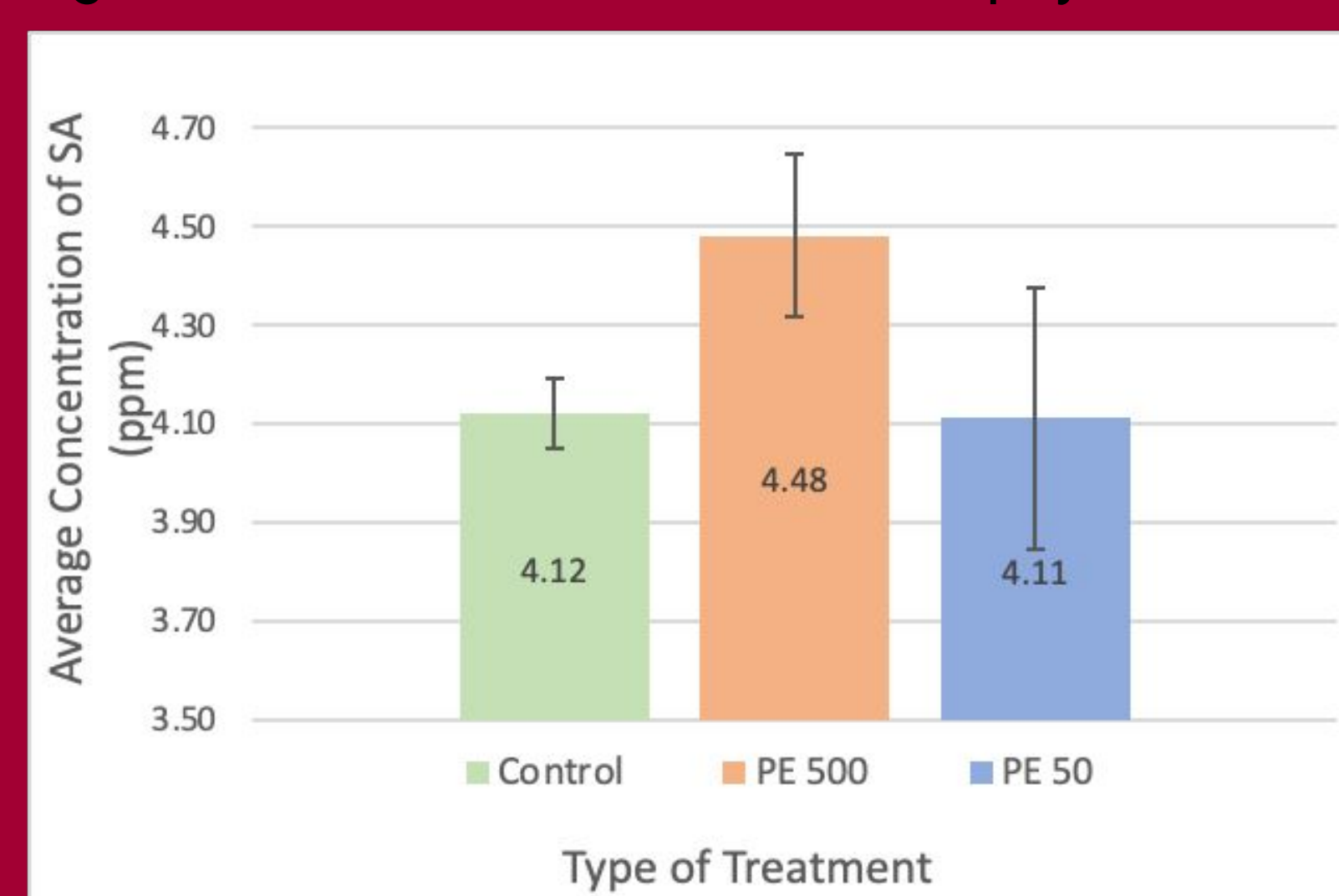


Figure 4: Treatment vs Salicylic Acid Content

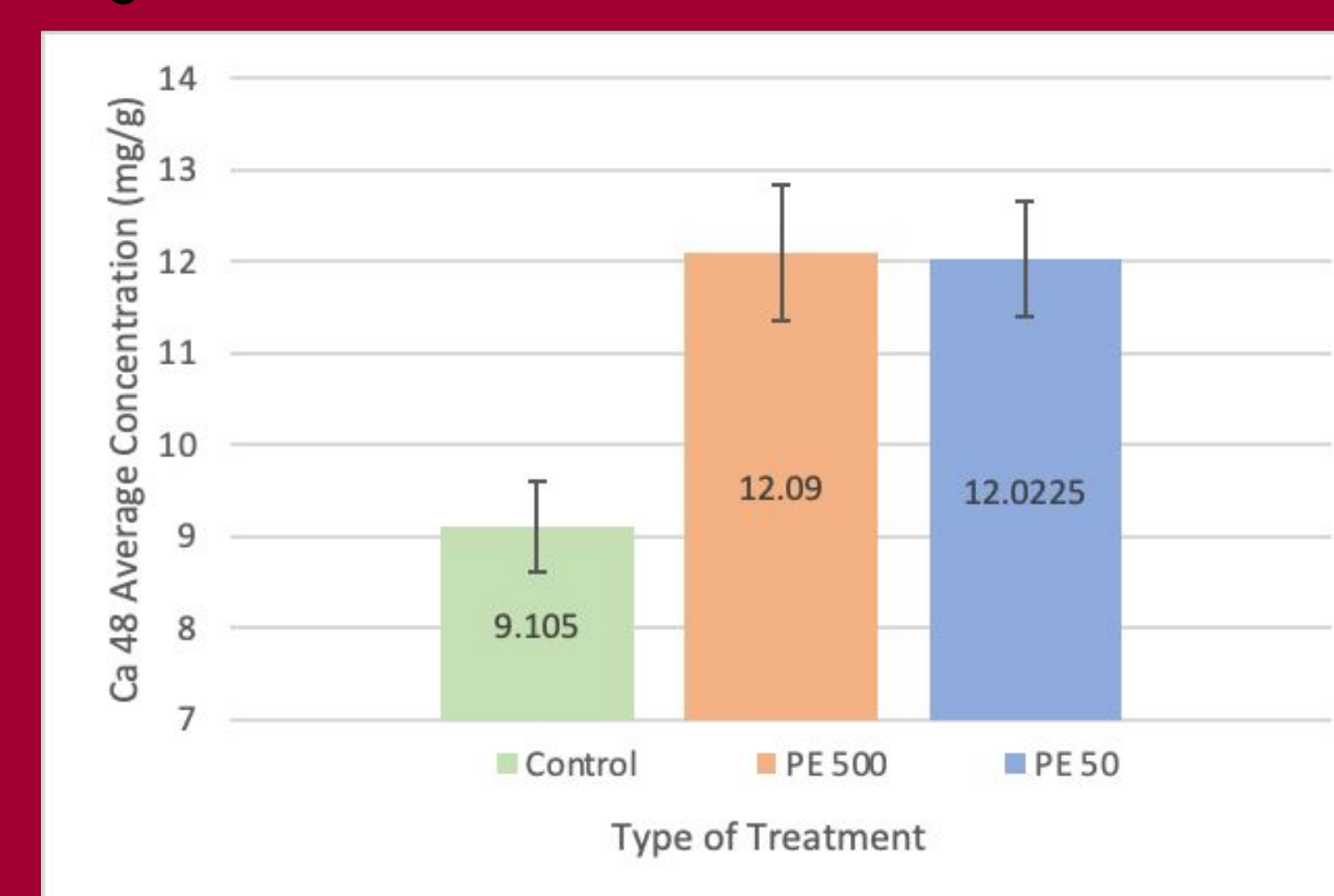


Figure 6: Treatment vs Calcium Content

DISCUSSION

Morphological Data

- Presence of PE 500 resulted in the largest decrease in fresh weight
- Total water content in the lettuce decreased most by PE 500
- Leaf density and plant height yielded inconclusive results

Nutrient Content/Heavy Metals

- Total chlorophyll content decrease most in PE 500 and was unaffected by PE 50
- Presence of PE 50 and 500 led to an increase in Calcium content
- Presence of PE 50 and 500 led to an increase in Cadmium content

Hormone Regulation

- Concentration of SA increased most in PE 500 and was unaffected by PE 50

FUTURE DIRECTIONS

- Concentrations of specific metabolite compounds such as proline can be measured on larger timescales.
- The impact of MPs on compounds with nutritional benefits within lettuce can also be studied (i.e Beta-carotene)
- Future research can involve analyzing rates of MP uptake and detection in the lettuce plants, possibly involving FTIR and Raman imaging or fluorescent tagging [10]

We thank our sponsors and supporters:



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References

Available via QR code:

