Comparing heavy metal content found in spinach (*Spinacia oleracea*) grown on the roof and ground sites at Portland State University

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Introduction

Green roof is as a roof with purposeful living vegetation

- Green roofs benefits
  - Reduces energy costs
  - Mitigates urban heat island effects
  - Improves water storm runoff
  - Reduces noise pollution
  - Increases roof life-span
  - Reduces air pollution
  - Utilize previously unused space

Green roof found on RSTC building on PSU campus

Green roof found on Karl Miller Center building on PSU campus

Introduction

- Benefits of Produce grown on roofs
  - Eliminate contamination from shipping
  - Eliminate pollution form shipping
  - Lower prices of produce
  - Fresher, cleaner produce
- Concerns of produce on roofs
  - Pollution of leafy greens
  - Heavy
  - Shallow roots

Birds eye view of Karl Miller Center building on PSU campus

Research Question:

Does growing food on the roof reduce heavy metal contamination?
How does the roof vs ground compare when it comes to heavy metals contamination?

Purpose

- Replicate a previously unpublished study
- To analyze air pollutants affect on leafy greens
- Compare different levels of roofs
- Define benefits and disadvantages of growing produce on roofs vs ground
- Explore potential urban agriculture sites
- Offer a direct route to fresh, clean, healthy food

Design

- Spinach beds
  - Cat trays for base
  - Potting soil
  - 3x7 seed planting pattern
  - Temp sensor
- Watered weekly unless it rains
  - Same water for each limit variables
- Air quality tests weekly
- Weekly monitoring
  - Measuring growth
  - Pictures

Design

- Spinach bed places at five rooftop locations and five ground locations in close proximity of each other at varying heights

Methods

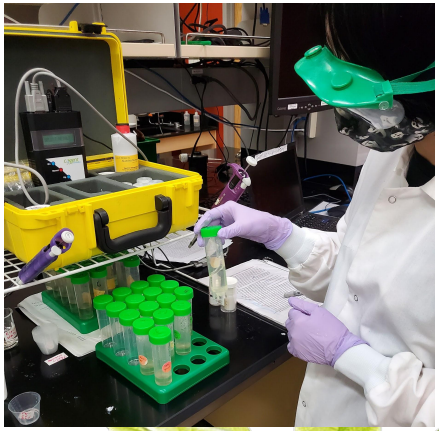
- Separate the leaves from the roots
- Dried and weighed
- Extraction
  1.Ground up leaves to powder
  2. Digested the leaves
  3. Filtered the solution
  4. Used ASV and ICP-OES machines to determine the concentration

1

3

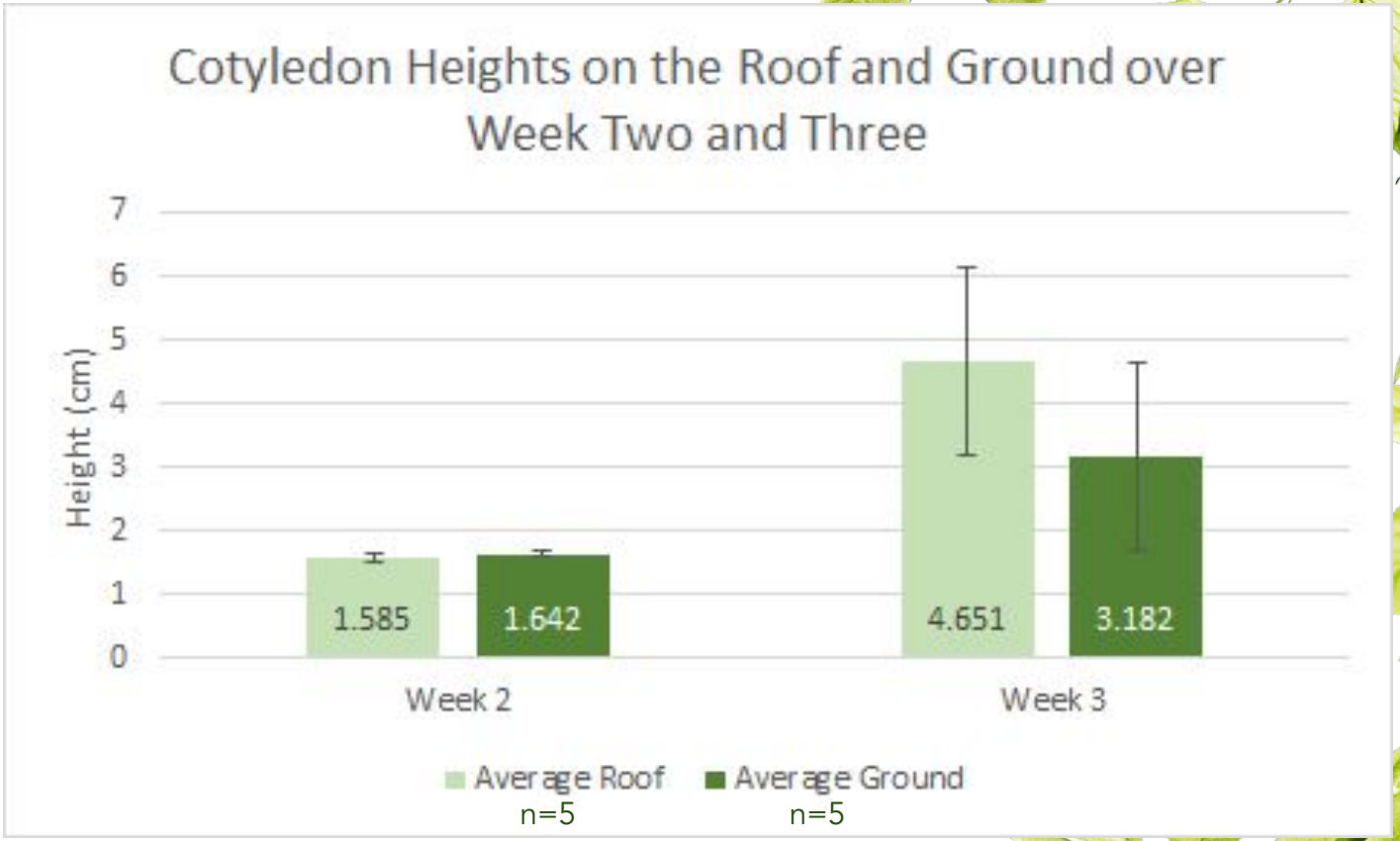
2

4



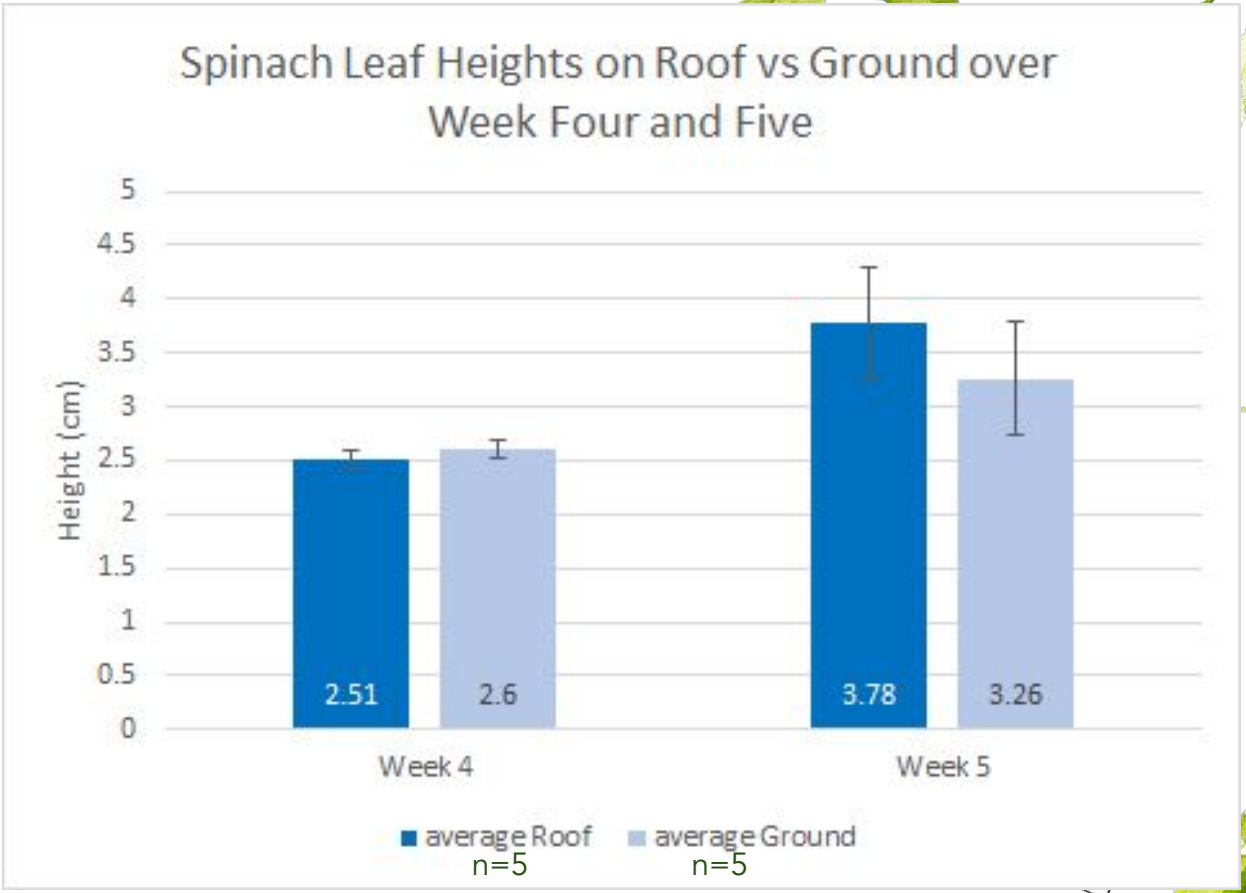
Growth Results

- Cotyledon, pre-leaves, growth is an indication of nutritional value in the early stages of the plant



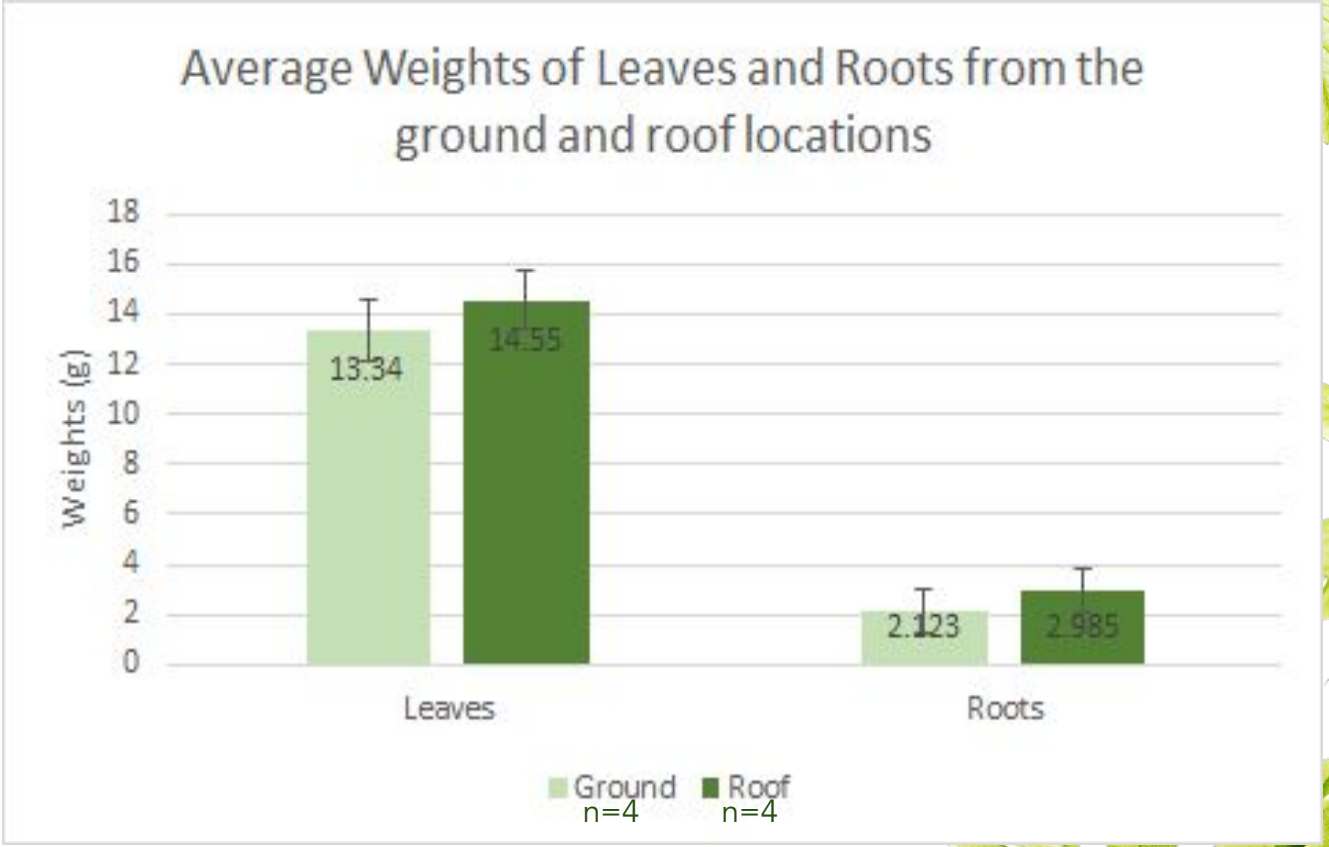
Growth Results

- More variation in the later weeks
- Week 4 showed spinach was growing taller on the ground locations
- Week 5 showed higher heights on the roof
- Outside influences, animals or humans



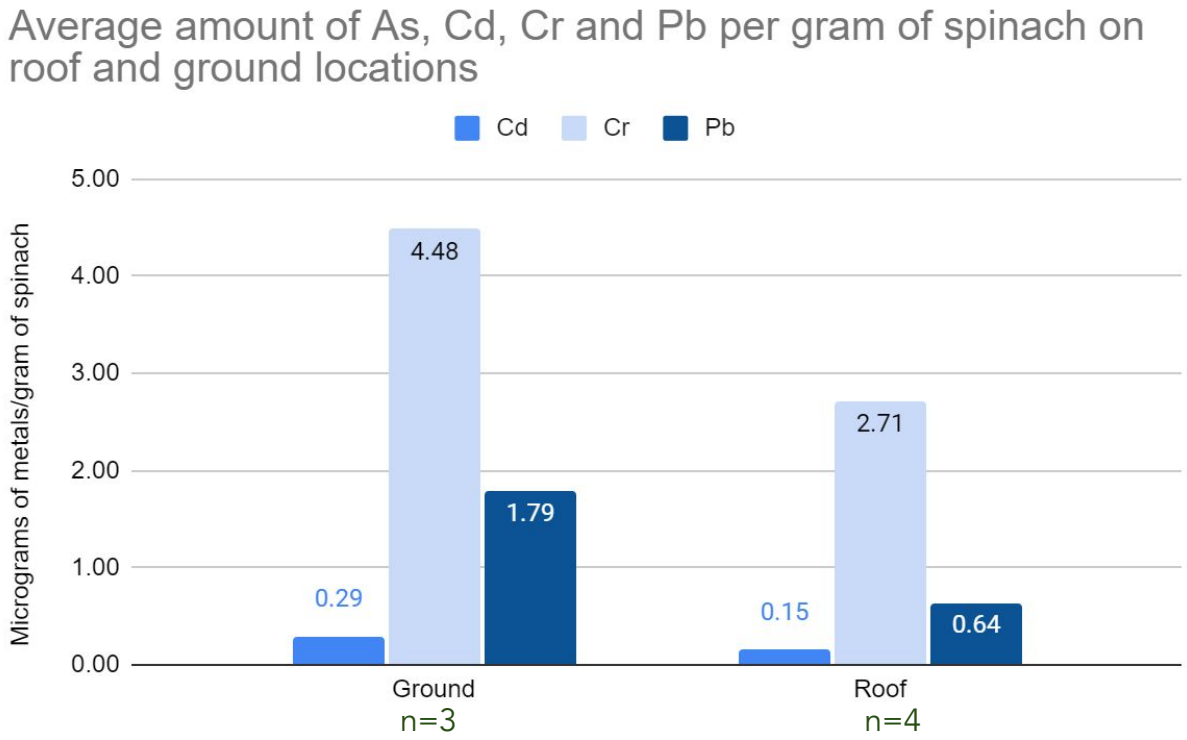
Growth Results

- Only 4 roof and 3 ground locations produced
- The overall weights showed higher yield on the roof locations for both roots and leaves



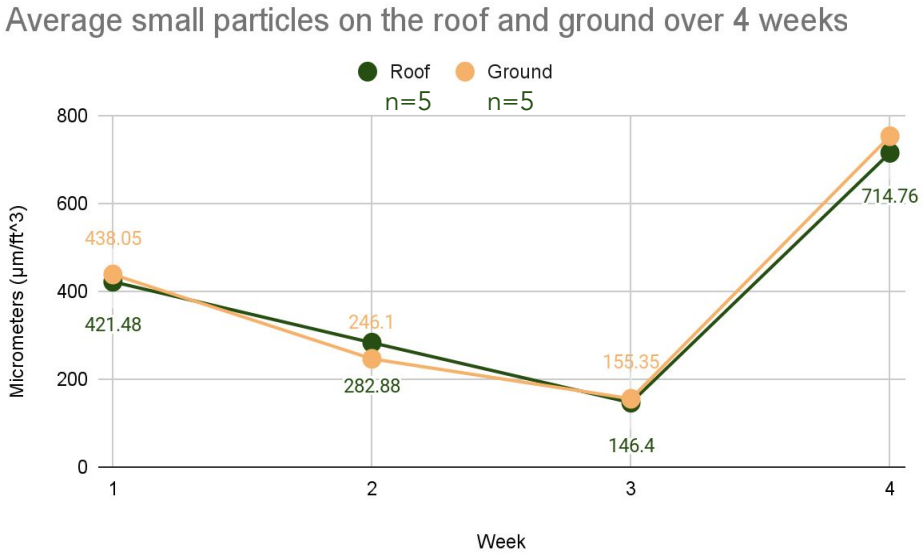
Heavy Metals Results

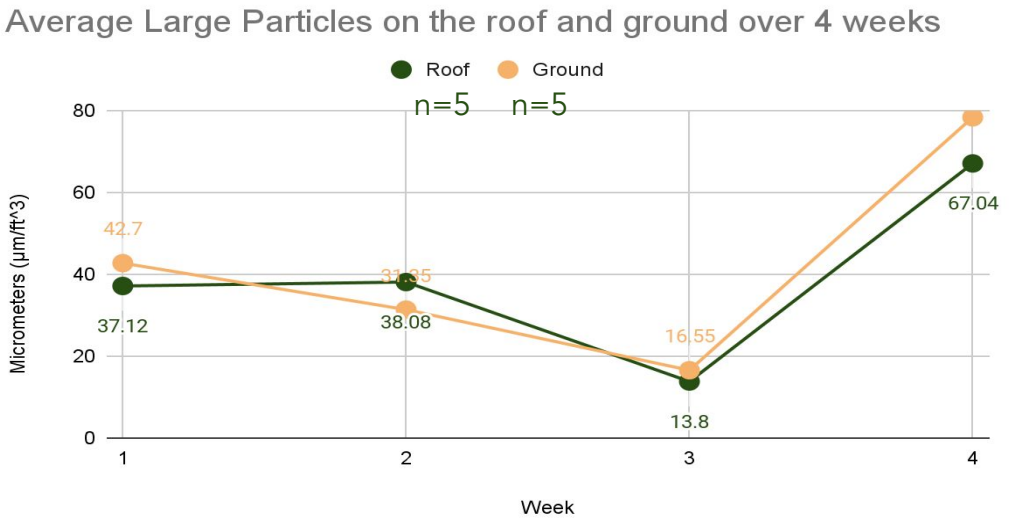
- ICP-OES machine results



Air quality Results

- Small particle air quality results





- Large particle air quality results

In conclusion

- Overall the roof locations grew more spinach and had fewer heavy metals
- Ground locations had issues with outside influence, reflects that ground locations have more potential to be disrupted by people or animals (crows, squirrels, dogs)
- Average large and small particles are less on roof vs ground, may have overlap in the heavy metals in spinach, more research to be done

Future Direction

- Replication of the study with more ground locations and more barriers in place
- Replication of the study using a different plant that grows better in this area

Works Cited:

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