ASGSR 2021 Baltimore, Maryland

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My crop of choice: Microgreens!

- Small space to grow
- Rapid turn around
- Large variety
- Dense nutrition
- Yummy

Sandwich with Scarlet Frills Mustard microgreens.

Health Benefits of Microgreens

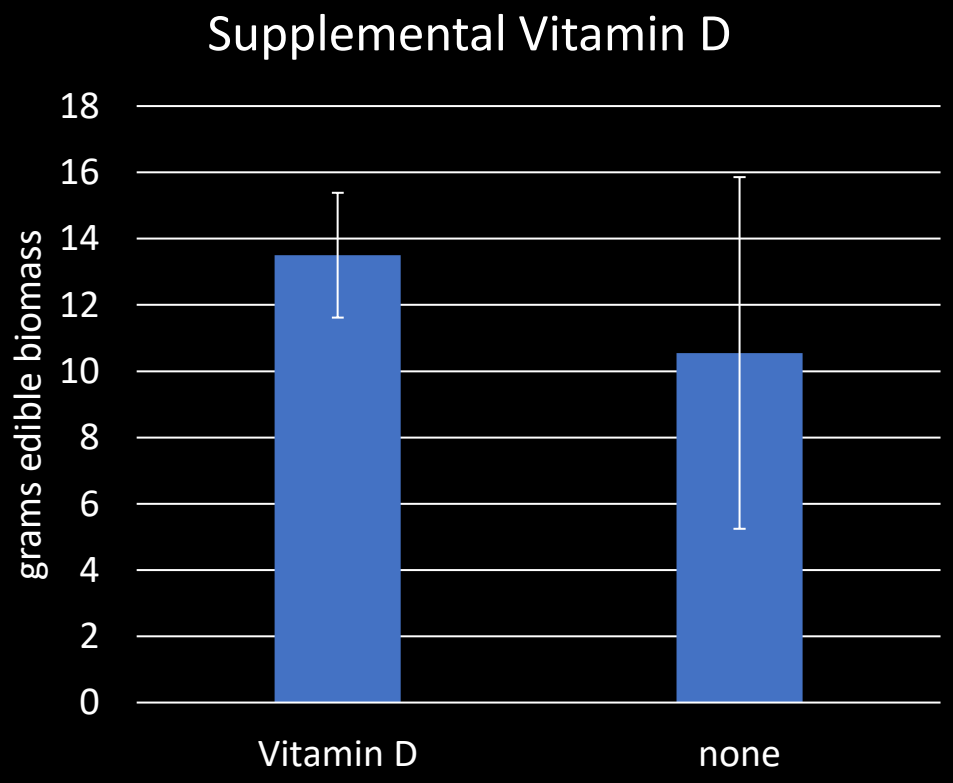
	Vitamin K (µg/100g) FW		**Vitamin C (µg/100g) FW**	
	microgreen	mature	microgreen	mature
Radish	180	1.3	95.8	14.8
Mizuna	200	2320	42.9	14.1

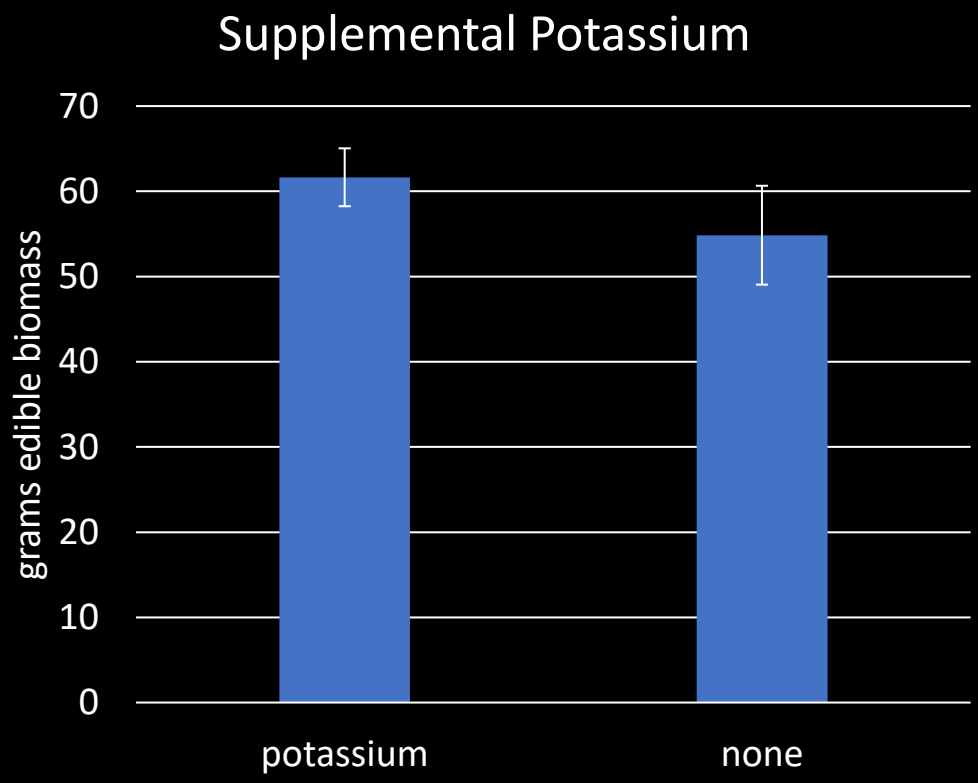
Testing Specialized Fertigation Blends for Agronomic Biofortification for Spaceflight Applications

This is the title of the talk that you saw in the program!
Most of this presentation is not on this topic.

Preliminary Data!

Microgreens can grow when given small amounts of supplemental nutrients!





Note that I do not mention environmental conditions. This is because they varied.

Anything else to report? Nope.

- Wasn’t getting consistent grow-outs with existing methods
- Contamination from algae and fungi

- Decided to focus on getting consistent, good growth instead

Substrate tests

Examples of Substrates:

- Potting soil
- Arcilite
- Biostrate
- Phytagel
- Hemp fiber
- Filter paper
- Germination paper
- Medical Gauze
- Screen
- Paper towel
- Coffee grounds
- Felted bamboo
- Scrubbing pads

Desired Characteristics:

- Wettable, re-wettable
- Easily sanitized
- Room for roots to grow
- No FOD
  (foreign object debris)
- Potential for re-use

Radish microgreens in a tray, growing under a LED light cap

Improvements

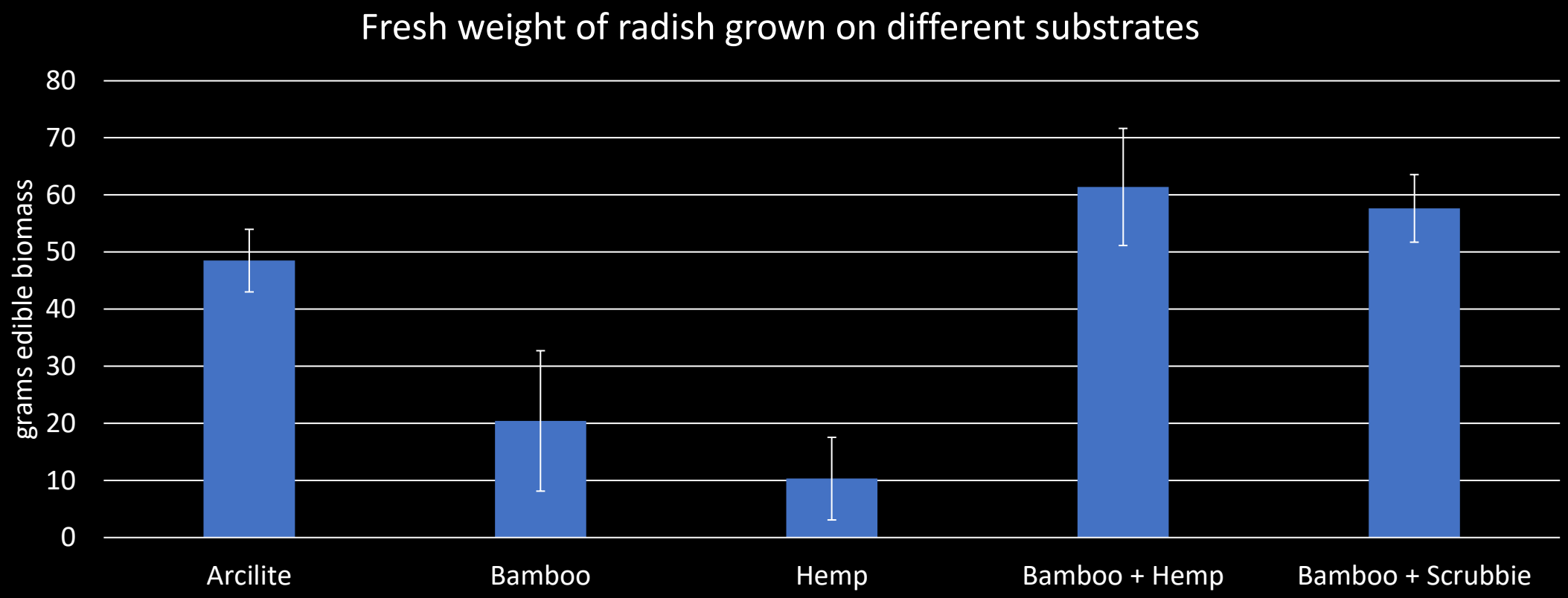
- Consistent lighting with Veggie analogs
  - Intensity of light
  - Spectrum of light
  - Photoperiod
  - Distance of plants to light cap
- Walk-in growth chamber Vertical Farm
  - Several trays of plants in one chamber, all growing in the same environmental conditions
  - Repetition with consistent results

Materials Biocompatability

Scrubby without off-gassing vs Scrubby with off-gassing + felt

Results!

(Just not the ones I expected to share by now)



- 13 cm x 20 cm trays with humidity domes, each with 4g seed.
- Hoagland's nutrient solution, half strength.
- Lighting: "Bright White" mix of red, green, and blue LED lighting
- Photoperiod: 16h on / 8h off

- Temperature: 23°C
- Relative Humidity: 75%
- CO2: 1000 ppm

Results!

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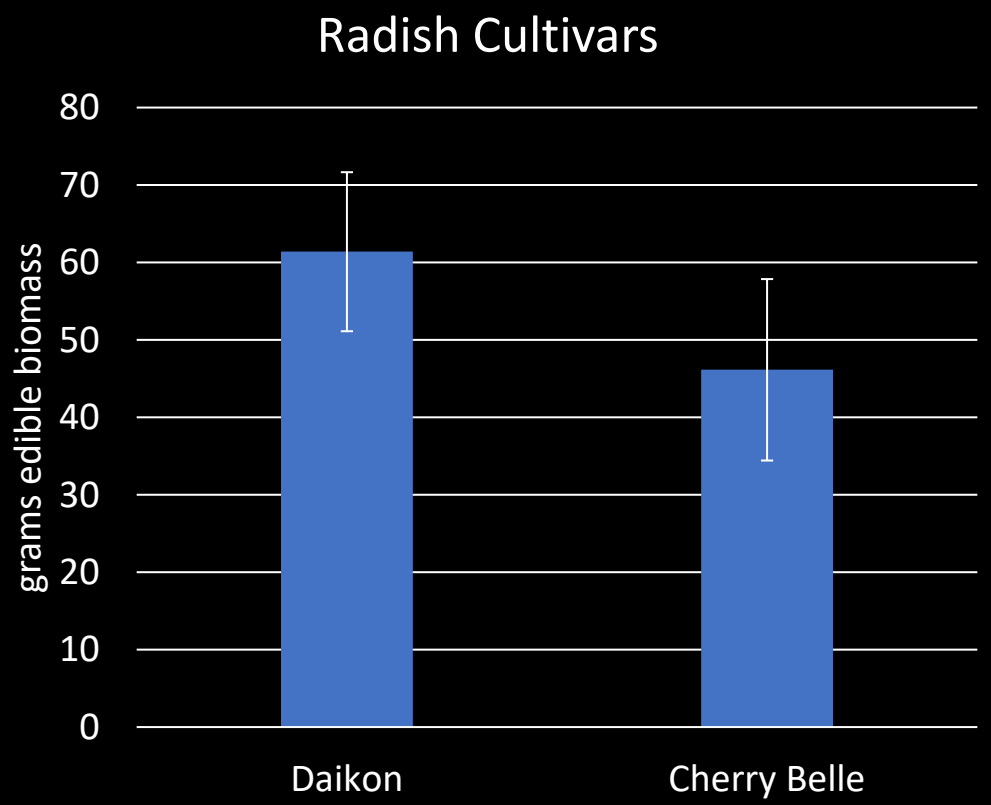



Cherry Belle radish microgreens

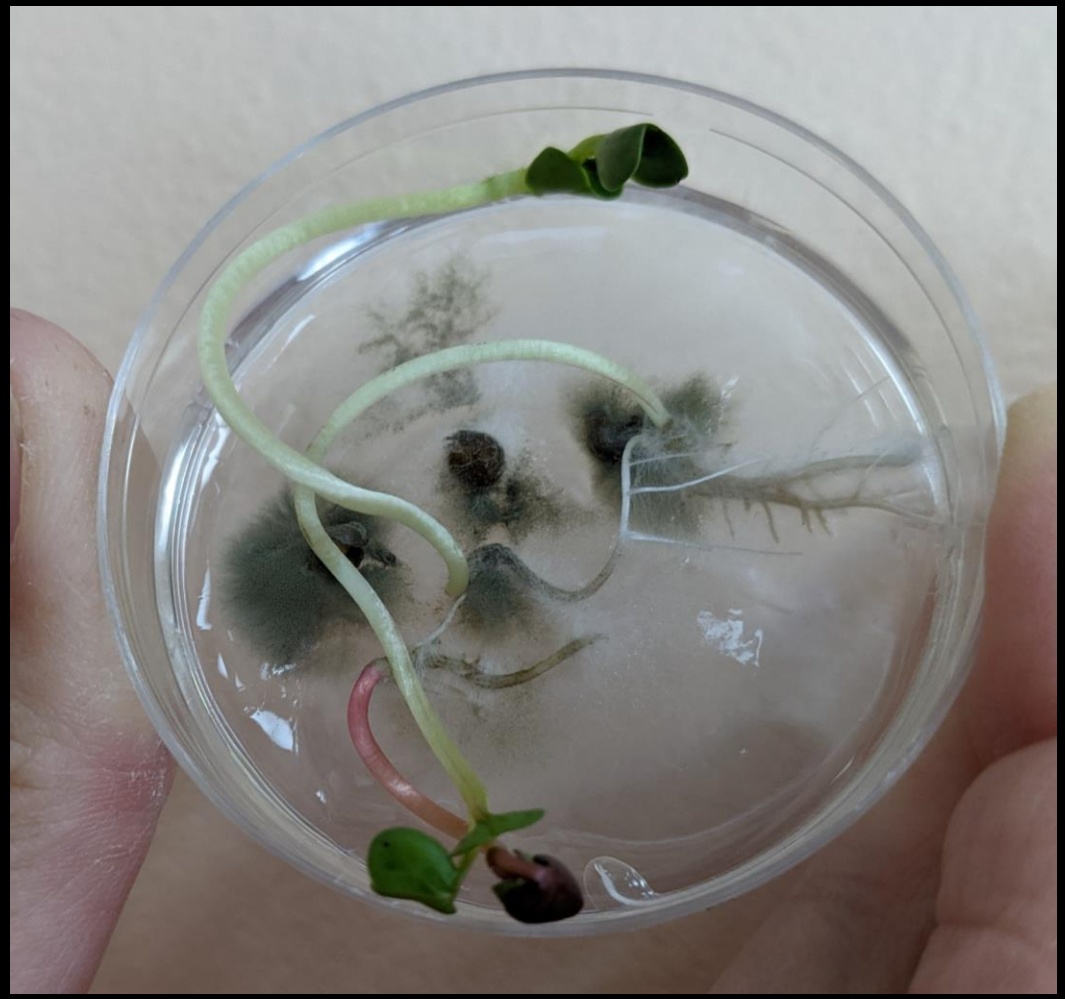
- 13 cm x 20 cm trays with humidity domes, each with 4g seed.
- Hoagland's nutrient solution, half strength.
- Lighting: "Bright White" mix of red, green, and blue LED lighting
- Photoperiod: 16h on / 8h off

- Temperature: 23°C
- Relative Humidity: 75%
- CO2: 1000 ppm
- 9 days of growth

Seed Sanitization

I tried out a few different options.

- Nothing
- 70% isopropanol and nanopure water
- Chlorine gas
- Plasma (see poster by Haley Boles)



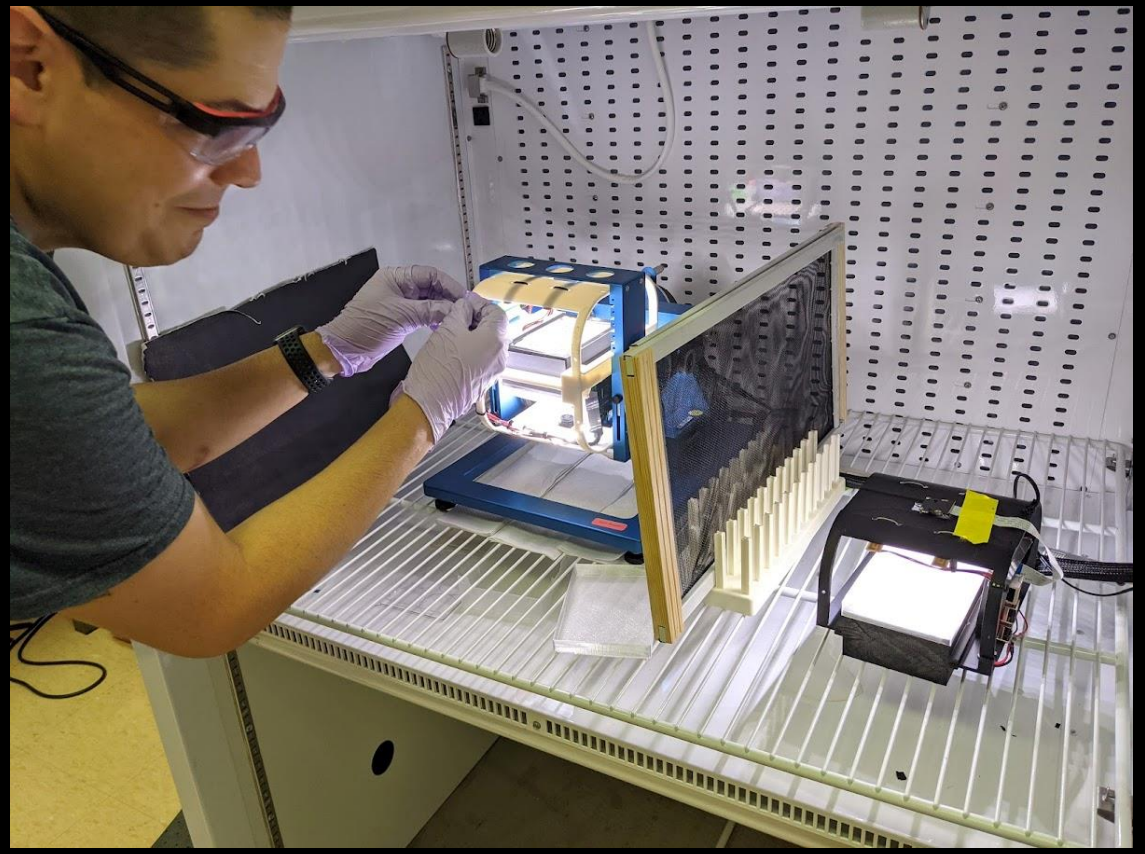
Contamination is visible on a plate with Cherry Belle radish. These were grown on a clinostat. The medium is phytagel.

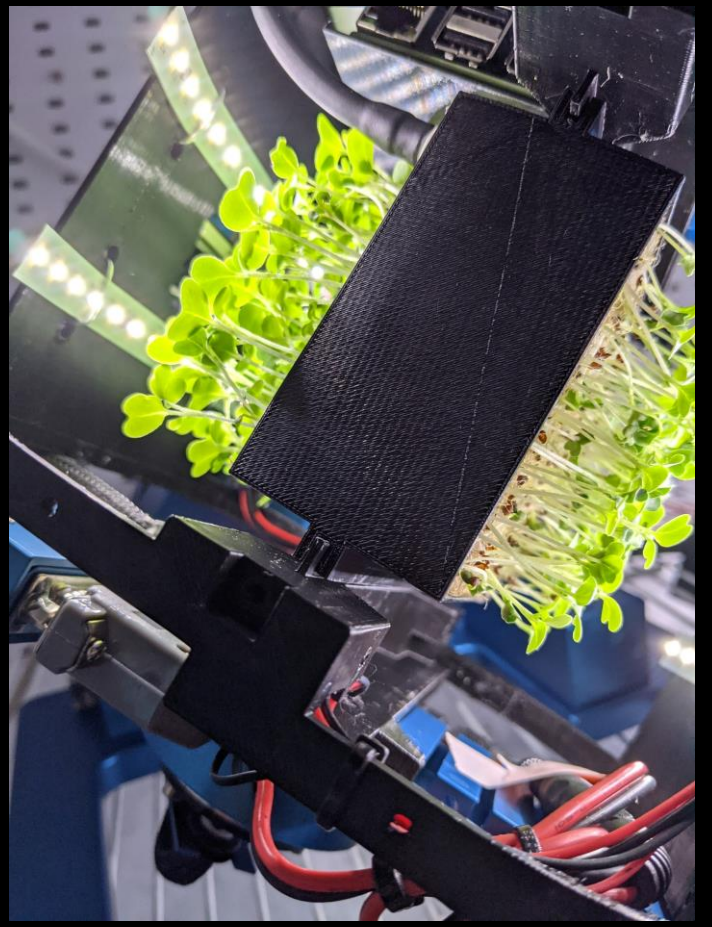
Applying what we learned…

- Microgreens on microgravity simulators
- Parabolic flight for microgreen harvesting methods

Daikon radish microgreens at harvest.

Microgreens in Simulated Microgravity

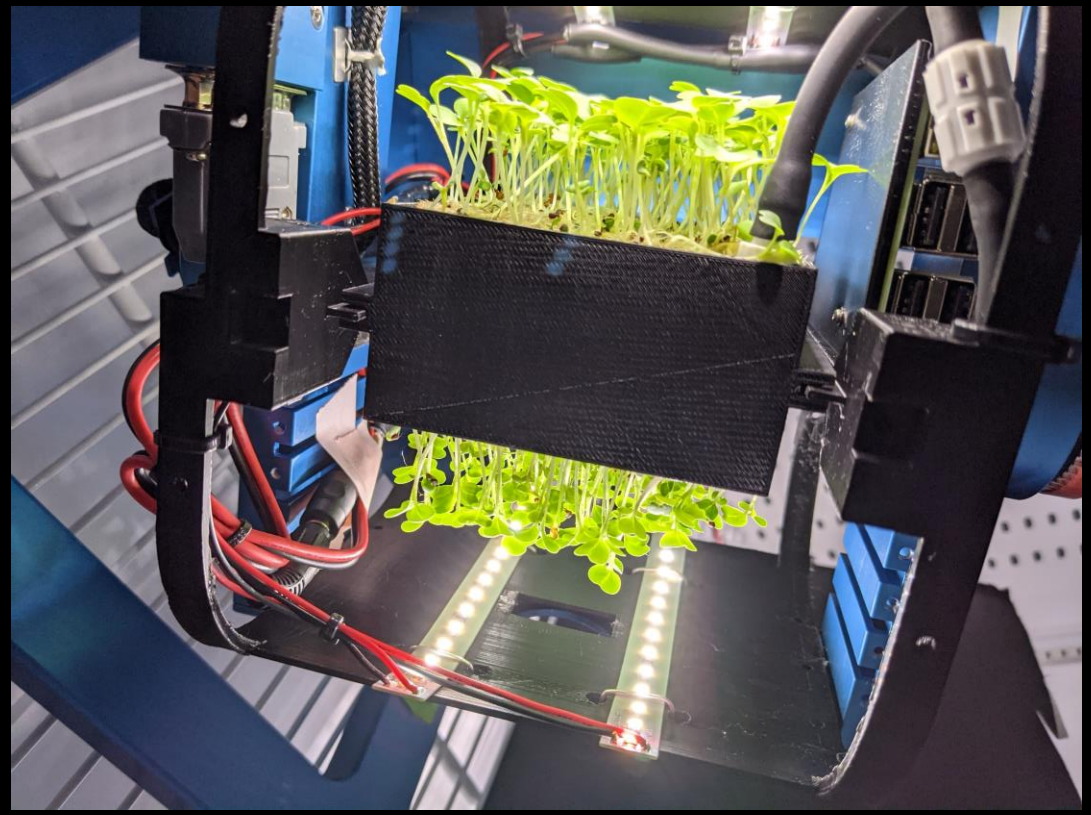




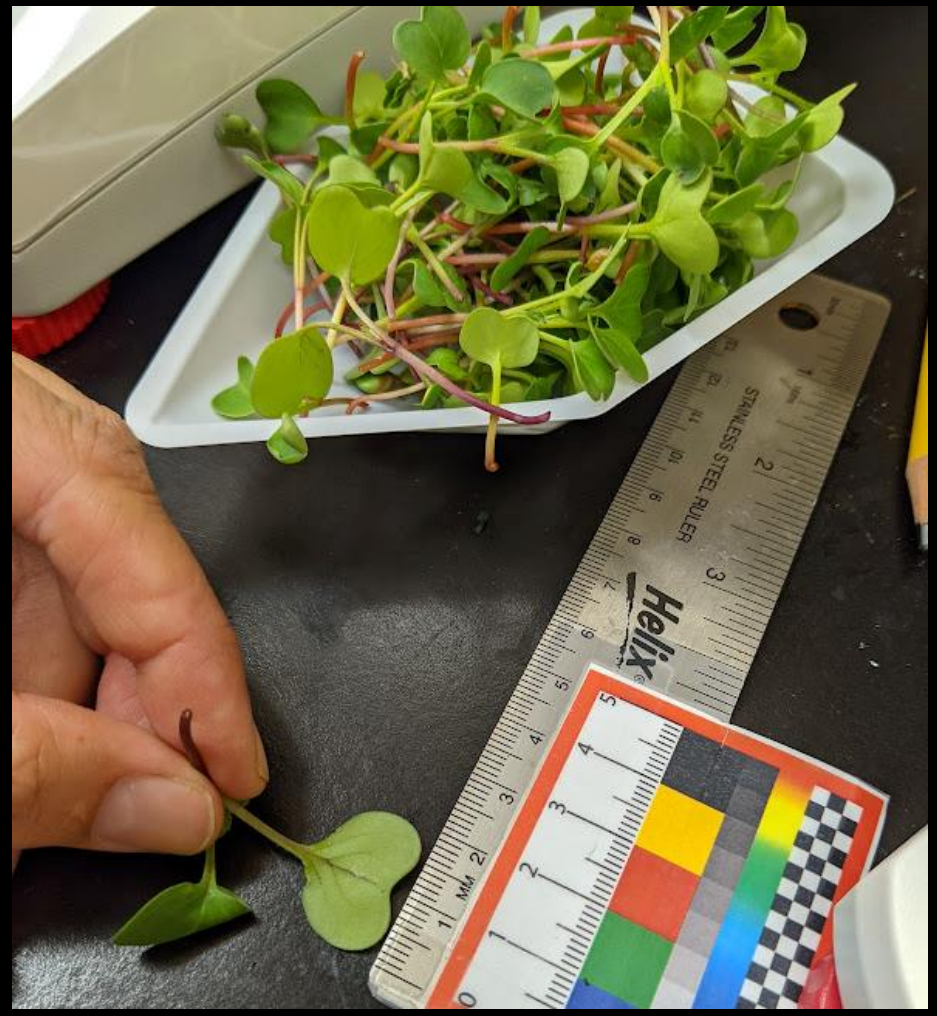
We started growing microgreens like a crop on Random Positioning Machines

Simulated Microgravity vs Stationary Control

- Preliminary data only at this point. Here are some pictures!



Radish microgreens growing in the specialized hydroponic grow box.



Harvesting one tray of microgreens

Microgreen Harvesting Techniques

We will test harvesting techniques with a parabolic flight using a glove box on loan from Dr. George Pantalos.

Check out posters from these folks!

Bioinformatics for Space Crop Production Virtual Interns

- Josie Pechous
- Zaafira Haque

Other SPROUTS

- Joey Emhof
- Haley Boles
- Chloe Alexander
- Mesgana Admassu
- Karen Perkins

Colleagues

- Iris Yang
- Gil Cauthorn
- Lori Waters

Year 3: NASA Postdoctoral Program.


SPACE PLANT BIOLOGY
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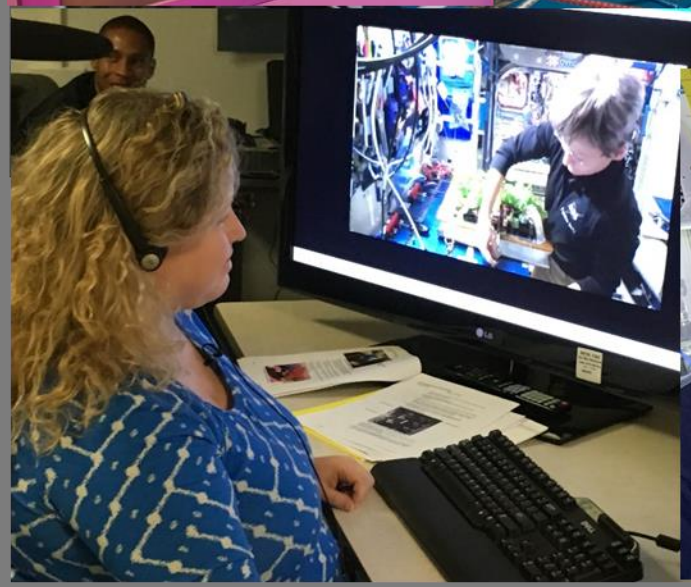
ADVANCED PLANT HABITAT
Large Plant Research Facility


SPACE PLANT BIOLOGY
Veggie
Food Production and Astronaut Nutrition



Have you grown microgreens in space?

Not yet! But I did grow another plant in 2010…