

**Plant the Moon Challenge Junior
Final Project Report
Team: New Affton Space Administration (NASA)
1st & 2nd Grade Gifted Students**

Independent Variable

IV
combination
of lunar regolith,
worm castings, sand,
soil

Dependent Variable

DV
how much our
carrots grow, we will
measure the height of the
greens, the circumference
of the carrots and
their mass.

Controls/Constants

○ carrots
○ water
○ grow lights
○ same pots
○ same spot

Hypothesis

(H)
If we plant our seeds in a mixture of regolith, soil, and worm castings, then we will grow the Best Carrots!

Background/Reasoning

We chose the moon because we want to help the astronauts survive on there and more astronauts have been there already. We chose carrots for our crop because they are healthy for astronauts and they can eat the whole plant so astronauts won't throw anything away. Carrots are also good for astronauts' eyes so they can see cool stuff like stars. We chose to add worm casting to some pots because they have nutrients to help the plants grow faster and healthier. We also added sand to some pots to make it easier for the carrots to push down.

Experimental Rationale

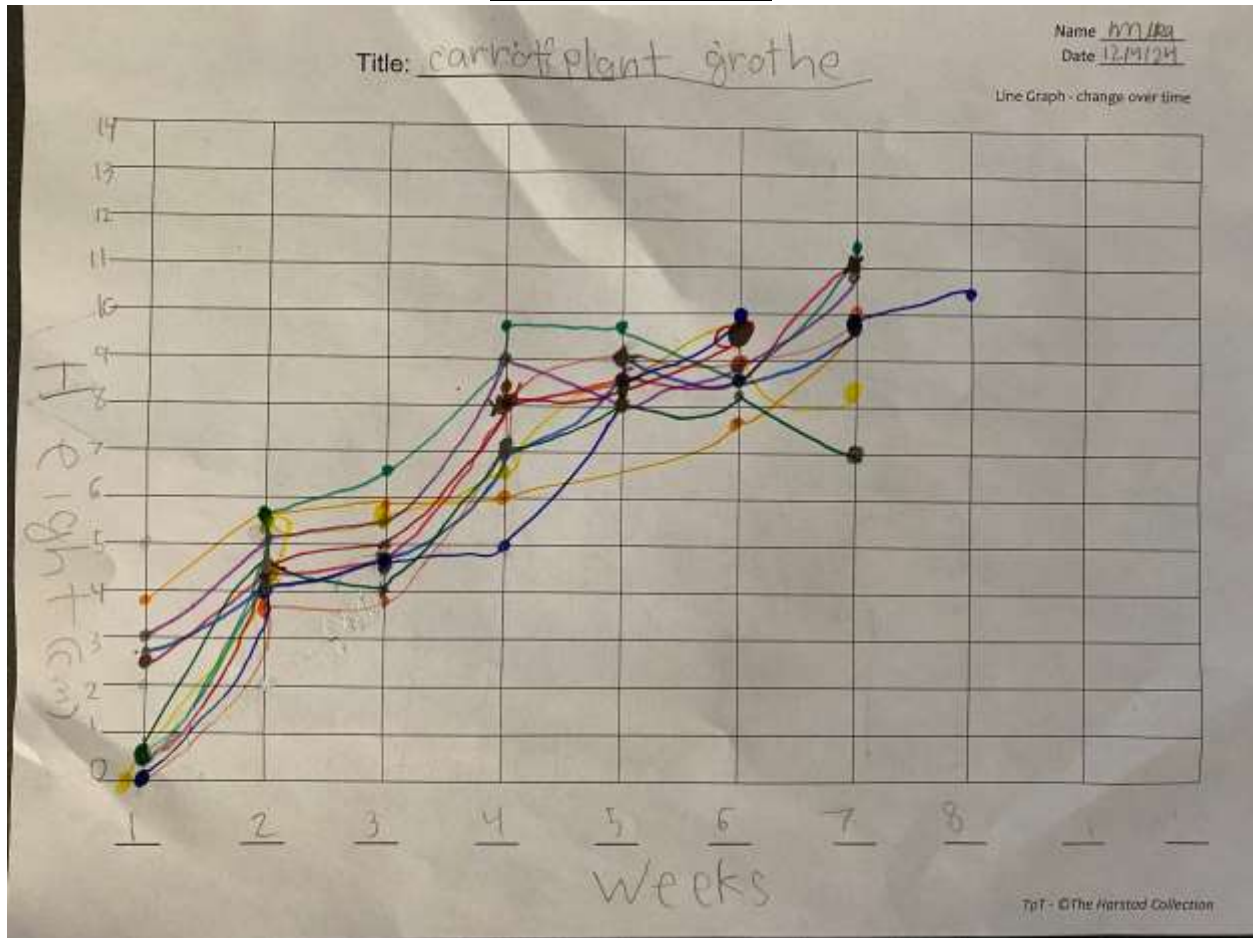
Our experiment results will help astronauts grow carrots on the Moon so they can live there some day. Our result will tell astronauts which soil combination is best to grow carrots.

<u>Grow Pot Setup</u>			
	Soil Composition	Amendments	Crop
Pot 1 (control)	100% Earth soil	N/A	Paris market carrots
Pot 2 (control)	100% Earth soil	N/A	Paris market carrots
Pot 3	100% lunar regolith	none	Paris market carrots
Pot 4	100% lunar regolith	none	Paris market carrots
Pot 5	50% lunar regolith + 25% Earth soil+ 25% worm castings	Earth soil + worm castings	Paris market carrots
Pot 6	50% lunar regolith + 25% Earth soil+ 25% worm castings	Earth soil + worm castings	Paris market carrots
Pot 7	75% lunar regolith + 25% Earth soil	Earth soil	Paris market carrots
Pot 8	75% lunar regolith + 25% Earth soil	Earth soil	Paris market carrots
Pot 9	50% lunar regolith + 25% Earth soil + 25% sand	Earth soil + sand	Paris market carrots
Pot 10	50% lunar regolith + 25% Earth soil + 25% sand	Earth soil + sand	Paris market carrots

Procedures

1. Fill control pots 1+2 with 100% soil.
2. Fill pots 3+4 with 100% regolith.
3. Mix 50% regolith, 25% soil with 25% worm casting in pots 5+6.
4. Mix 75% regolith with 25% soil in pots 7+8.
5. Mix 50% regolith with 25% soil and 25% sand in pots 9+10.
6. Plant 5 Carrot Seeds $\frac{1}{2}$ inch deep in each pot.
7. Use meter when watering to stay in green zone.
8. Set grow lights to be on 12 hours and off 12 hours.
9. Observe plants once a week and measure.

Data Collection



Line Graph Key		
Pot Number	Amendments	Line Color
1	control	purple
2	control	blue
3	100% regolith	green
4	100% regolith	red
5	25% soil 25% worm cast	pink
6	25% soil 25% worm cast	yellow
7	25% soil	teal
8	25% soil	orange
9	25% soil 25% sand	dark blue
10	25% soil 25% sand	light green

Week 8 Data & Measurements (cont.)

	Pots									
	1	2	3	4	5	6	7	8	9	10
Weight of Carrots with Tops (g)										

39 19 159 29 19

***Note:** The carrot plants were too light to weigh on their own, so we weighed the combined plants from both pots with the same amendments and recorded those measurements.

Observations

Our carrot plants grew a lot. The plants in pot 7 grew tallest. We did not grow any carrots, but there was as much as astronaut can eat the greens too. The greens in pots 7 and 8 weighed the most.

Analysis

Our most successful plants grew in 75% lunar regolith and 25% Earth soil. We figured this out by measuring the tallest plant in each pot every week. The tallest plant at the end of 8 weeks was pot 7. It was 11.5 cm. We also weighed the plants at the end of the experiment. The plants in pots 7 and 8 weighed 2g together. They were the heaviest.

Future Considerations

We are not sure why our carrots didn't grow. If we tried this experiment again, we might grow the plants in bigger pots to give the carrots more space. We also learned about thinning the plants to grow bigger carrots, so we could try that too.

Conclusion

Our best carrots grew in pot 7 and 8 with 75% lunar regolith and 25% Earth soil. We thought pots 5 and 6 were going to be the best because of the worm castings but our results do not show this. None of our carrots ^{grew} but our results can still help astronauts who want to live on the moon. The green parts of our plants were very tall and healthy. So astronauts could still grow those and eat them. And it is surprising that the plants only needed 25% soil to grow so tall! That is good news for astronauts who don't want to take a lot of amendments with them to the moon. We recommend the astronauts try growing the carrots in bigger pots because we think they will grow better if they have more space.

While doing this experiment, we learned that carrots might need more time and space to grow than we thought. We also learned that it is possible to grow carrots in lunar regolith. We thought nothing would grow in it!