

Initial Experimental Design

Physics Seniors 1st block

Arcadia High School

February 17, 2023

Parameters

Find the optimal maximum regolith (lunar simulant) to soil (potting mix) ratio that allows for growth of vegetables. The minimum ratio is 50 percent regolith to 50 percent soil by volume. Higher regolith to soil ratios; 60 percent to 40 percent, 70 percent to 30 percent, and 80 percent to 20 percent will be used for study.

Broccoli is ranked number one, and peas are number eight of the 10 best vegetables for clay soil (Will, 2021). Broccoli is also ranked number three, and peas are number seven of the 14 healthiest vegetables (Link, 2022). Both broccoli and peas will be planted in each pot, as the growing season is eight weeks (56 days). Broccoli takes approximately 100 days to grow from seeds (Schuh, n.d.). Peas grow from seeds in roughly 60 days (Tong, n.d.).

Variables

The ratio of regolith to soil by volume is the independent variable; 50/50, 60/40, 70/30 and 80/20. Growth in centimeters of broccoli and peas is the dependent variable. A pot with 100 percent potting soil mix is the control. Distilled watering is not controlled by volume as different regolith/soil ratios soak up differing amounts of water.

Hypothesis (Research Question)

How can the transport of soil by volume to the moon be minimized?

Experimental Design and Procedures

Five plastic pots (15 cm diameter, 13.5 cm height) with drainage holes and saucers; 625 mL regolith/625 mL soil, 750 mL regolith/500 mL soil, 875 mL regolith/375 mL soil, and 1000 mL regolith/250 mL soil will be mixed and moistened. Organic broccoli and pea seeds will be planted in each pot, one cm and 2.5 cm deep, respectively. A fume hood will be used for safety (before regolith is wetted), and later as an indoor greenhouse, with a grow light set on a 12 hour on-off cycle, full spectrum, and 100 percent brightness.

Pots will be watered daily (on weekdays) from the bottom via their saucers. pH and plant growth (once visible above the regolith/soil) will be measured weekly.

Contingency Plan

During the spring break week, April 3-7, the teacher will check and water plants, if possible.

Grow Pot Setup

Pot	1 (control)	2	3	4	5
Soil	100% soil	50% regolith	60% regolith	70% regolith	80% regolith
Amendments					
Crop	broccoli/peas	broccoli/peas	broccoli/peas	broccoli/peas	broccoli/peas

References

Tong, A. C. (n.d.). *Growing peas in Home Gardens*. UMN Extension. Retrieved February 15, 2023, from <https://extension.umn.edu/vegetables/growing-peas#:~:text=Most%20varieties%20of%20peas%20need,may%20also%20have%20poor%20quality>.

Schuh, M. (n.d.). *Growing broccoli in Home Gardens*. UMC Extension. Retrieved February 15, 2023, from <https://extension.umn.edu/vegetables/growing-broccoli#:~:text=For%20spring%2Dplanted%20broccoli%2C%20choose,are%20forming%20in%20cooler%20temperatures>.

Will, M. (2021, October 6). *10 best vegetables for clay soil*. Empress of Dirt. Retrieved February 15, 2023, from <https://empressofdirt.net/best-vegetables-clay-soils/>

Link, R. (2022, March 1). *14 of the healthiest vegetables around*. Healthline. Retrieved February 15, 2023, from https://www.healthline.com/nutrition/14-healthiest-vegetables-on-earth#TOC_TITLE_HDR_2