Investigating Food Plant Growth Under Martian and Lunar Conditions: Testing Extraterrestrial Soil and Light Conditions on Plant Viability

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Introduction

A new, very active area of research has developed at NASA and private institutions, around the science of plant cultivation on Mars. This cultivation opens opportunities to save money and time when sending food and other useful organisms to the humans off planet (1,2). By simulating soil composition as well as lack of ozone in the atmosphere of these celestial bodies will provide very useful information needed for future space missions. This experiment will consist of growing food plants in 2 types of soils, one being plain earth soil, and the other two consisting of Martian imitated soil. The next portion of the experiment is the absence of ozone or UV direct contact. Both variables give a sense of what it would be like to grow useful plants in these environments. On Mars, however, crops must be grown under controlled conditions (greenhouse or growth rooms) (5). The Scientist’s role in this experiment is to set up the experiment and monitor the plants, taking measurements and gathering the data at the end of the experiment which will be drying the plants out and weighing them for comparison. The method that will be used is having two overall groups of UV exposed plants and within those two groups there will be 3 of each type of soil. By the end of the experiment, the scientist is going to measure the heights of the plants for comparison. When measuring the plants, the scientist is going to use centimeters and measure from the soil to the tip of the plant. In Reference 1, growth is explored inside the Martian soil but never added in the factor of UV rays and a colleague has done the UV experiment without the simulated soil. So, the scientist will be combining both experiments to create more enhanced data for future space missions. The soil will most likely have to be bought, to save more time focusing on the plant growth and preparation.

Materials & Methods

Prior to growing the plants under the UVC light, there was a tarp that was set to divide the plants and make sure no UV light touches the non-UV plant group. The Scientist then zip ties tubes from the watering system on the same rack the tarp was tied to above the plants. The water system was then set to start at 6 am for 2 minutes every day. After the watering system was set up, the UVC lights were installed and using the same rack, the scientist then placed the UVC lights to the UV exposed side of the tarp and set a timer for every day of the week 10-2. Once the simulated environment was set up, the scientist then potted 20 of each group of radishes, being non-UV earth soil, non-UV mars soil, UV earth soil, and UV mars soil. For the next 3 weeks the radishes growth was observed, and the height was measured at the end of the experiment to show which group of radishes grew the most.

Results

The different columns represent the different groups that were made for the experiment. The non-UV earth soil has the best growth out of any of the groups in the experiment as UV mars has the worst growth out of the four.

NON-UV earth	NON-UV mars	UV earth	UV mars
5.1 cm	0 cm	2.1 cm	0.9 cm
7.4 cm	8.5 cm	1.8 cm	0 cm
6.8 cm	9.5 cm	3.4 cm	0 cm
9.9 cm	0 cm	1.1 cm	0 cm
8.4 cm	0 cm	2.1 cm	0 cm
8.7 cm	0 cm	2.6 cm	0 cm
9.2 cm	0 cm	1.9 cm	0 cm
8.6 cm	0 cm	2.3 cm	0 cm
5.7 cm	0 cm	3.8 cm	0 cm
9 cm	7.1 cm	2.6 cm	0 cm
8.8 cm	9.1 cm	2.3 cm	0.3 cm
7.6 cm	8.2 cm	0.8 cm	0 cm
7.8 cm	7.0 cm	3.6 cm	0 cm
9.1 cm	0 cm	3.1 cm	0 cm
9 cm	0 cm	3.8 cm	0 cm
10 cm	7.9 cm	2.9 cm	0 cm
8.1 cm	0cm	2.4 cm	0 cm
9.8 cm	0 cm	5.4 cm	0 cm
10.4 cm	9.3 cm	2.7 cm	0 cm
11.5 cm	4.8 cm	6.3 cm	0 cm

Table 1: This table represents the heights measured after the 3 weeks of growth

Week 1 Result

UV side non-UV side

Figure 1(left) and Figure 2(right): The radishes in figure 1 and 2 are startting to germinate but figure 1 or the UV side has significantly less gorwth than the non-UV side

Week 2 result

UV side non-UV side

Figure 3(left) and Figure 4(right): The radishes in figure 3 have little to know change in growth while in figure 4 the radishes have significant growth

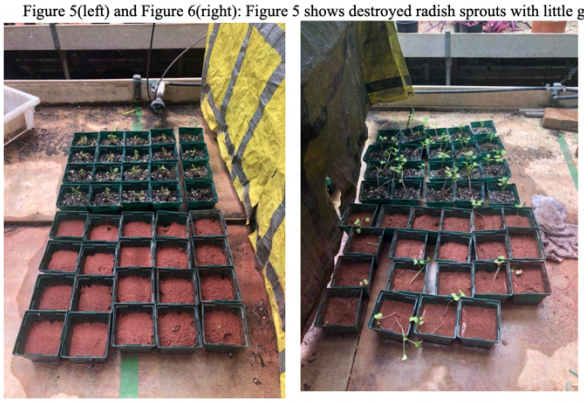
Discussion

As mentioned in reference 3, the analyzed rocks (from the pathfinder mission) are similar in composition to terrestrial andesites and close to the mean composition of earth's crust. Which explains why the radishes were able to grow in the Martian simulation soil but couldn't grow as well as the earth soil. The plant could've also influenced the growth as other plants might grow better in the Martian soil than the radishes. When it comes to the UVC light, the UVC light destroys all organic matter, and this also demonstrates what it would be like without an ozone layer.

Week 3 result

UV side non-UV side

Figure 5(left) and Figure 6(right): Figure 5 shows destroyed radish sprouts with little growth



after week 1 and in figure 6 the radishes experience major growth since week 1

Conclusion

In conclusion, the plants used in this experiment did not grow efficiently at all when placed in Martian conditions and this means when taking on

Mars missions, keep the plants in a controlled environment away from UVC light, Martian soil works but for efficiency use earth soil.

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