



Plant Mars Challenge

How does the rotation of plants affect the statoliths in gravity sensing cells and what percentage of coconut fiber versus regolith optimizes growth?

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"Alone we can do so little, together we can do so much" - Hellen Keller

Hypothesis

We are very interested in seeing what will happen if we periodically rotate the plants and believe that this effect will cause the plant to be disoriented, feeling a lesser impact of gravity and simulating growth in 0 or, at least, less gravitational pull.

Furthermore, we believe that the plants with a higher percentage of regolith will show more growth than the plants with higher percentage of coconut fiber. We believe this due to the fact that regolith has been made with the intention of providing nutrition for plants on a trip to Mars.

Finally, we think that plants will grow best in the control experiment, being the 0° inclination set up. We think this because less inclination would provide the plants with constant gravitation pull from the same direction.

Independent Variables

We have set up 4 different growing stations with varying inclinations at which 2 pots will rest and be rotated every 2 hours (a total of 8 pots): 0° inclination, 15° inclination, 30° inclination, 45° inclination.

Each station had pots with 2 different amounts of regolith and coconut fiber in each. Pot 1 had 50% regolith and 50% coconut fiber, Pot 2 had 75% regolith and 25% coconut fiber. All pots are filled with the growing mediums as well as an added fertilizer in the form of pills, which were added once at the beginning of the experiment.

All growing stations are equipped with special growing lights which are turned on for 8 hours each day.

We water the plants with 60ml of water, twice per day.

Dependent Variables

The effect of inclination of each plant and the difference in growth between the pots with 50% regolith versus the ones planted with 75% regolith.

The number of leaves that grow in each pot as well and the size of each of the plants that get successfully cultivated is a special job for the team to measure periodically as seen in the following chart.

Aside from the number of leaves, students measured (in cm) the growth of the plants in order to calculate the average daily growth of each of the plants in each of the pots.



"To plant is to believe in tomorrow"- Audrey Hepburn

Measurements

The Ph maintained a constant level of 6 throughout the growth period, without any noticeable variation.

Measurements of plant growth have taken place daily; the following table represents the final growth for each of the pots in the different inclinations.

| Degrees of Inclination | Growth Pot 1 (50% regolith, 50% coconut fiber) | Growth Pot 2 (75% regolith, 25% coconut fiber) |
|-------------------------------|--|--|
| 0° Inclination | 1.3 cm | 1.5 cm |
| 15° Inclination | 2.53 cm | 1.95 cm |
| 30° Inclination | 3.8 cm | 1.2 cm |
| 45° Inclination | 1.75 cm | 2.75 cm |

Subsequently, the team has broken down the information into average and daily numbers in order to deeply analyze the results of our experiments.

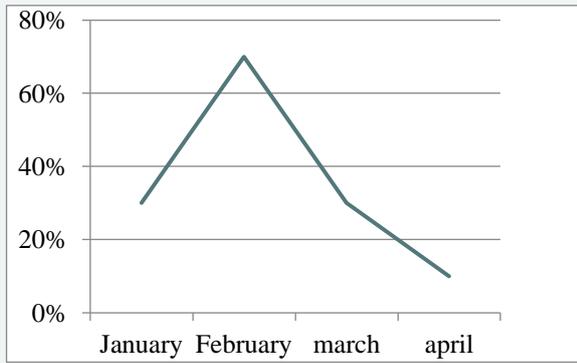
Each pot of 50% and 50% regolith and coconut fiber has 120ml of each, regolith, and coconut fiber. However, pots of 75% regolith and 25% of coconut fiber have 180ml and 60ml. The average growth of 75% and 25% is 1.375cm but the average of 50% and 50% is 1.7cm.

In 0°, 50% and 50% grows 0.204cm per /day and has grown 1.5cm. In 75% and 25% grows 0.0202cm per / day and has grown 1.3cm. The average of the box is 1.4cm.

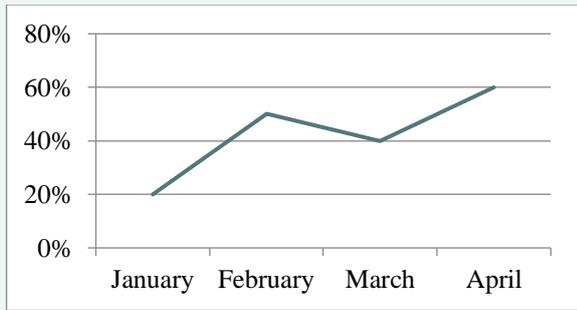
In 15%, 50% and 50% grows 0.0107cm per / day and has grown 1cm. And 75% and 25% grows 0.001cm per / day and has grown 0.1cm. The average of the box is 1.4cm.

In 30°, 50% and 50% grows 0.05cm per / day and has grown 2.9cm. And 75% and 25% grows 0.01cm per / day and has grown 1cm. The average of the box is 1.95cm.

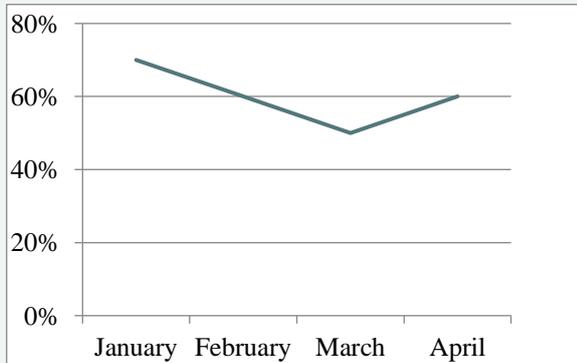
In 45°, 50% and 50% grows 0.02cm per /day and has grown 1.4cm. In 75% and 25% grows 0.05cm per / day and has grown 3.1cm. The average of the box is 2.25cm.



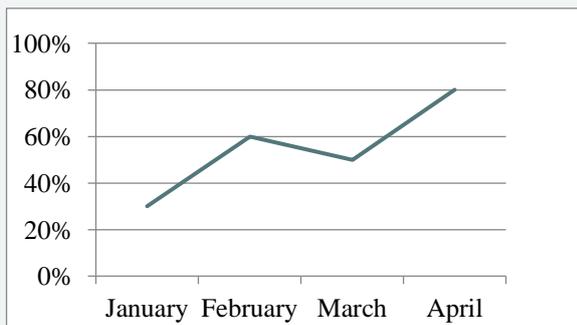
This chart represents the growth progress of the 0° inclination station throughout the grow period.



This chart represents the growth progress of the 15° inclination station throughout the grow period.



This chart represents the growth progress of the 30° inclination station throughout the grow period.



This chart represents the growth progress of the 45° inclination station throughout the grow period.

| GROWTH PER/DAY | | | | | | | |
|--------------------------------|----------|--------|--------|--------------------------------|---------|--------|--------|
| 50% REGOLITH 50% COCONUT FIBER | | | | 75% REGOLITH 25% COCONUT FIBER | | | |
| 0° | 15° | 30° | 45° | 0° | 15° | 30° | 45° |
| 0,204CM | 0,0107CM | 0,05CM | 0,02CM | 0,0202CM | 0,001CM | 0,01CM | 0,05CM |

| AVARAGE PER/BOX | | | |
|-----------------|--------|--------|--------|
| 0° | 15° | 30° | 45° |
| 1,4CM | 0,55CM | 1,95CM | 2,25CM |

Control

The control plants are those plants which we have planted in the 0 inclination pots, maintaining the same initial parameters as the other growth:

- 1 pot with 50% regolith, 50% coconut fiber
- 1 pot with 75% regolith, 25% coconut fiber
- 1 grow light
- 0° inclination

Results

CONCLUSIONS

Our conclusions in the Plant Mars Challenge are:

LIGHT: as the inclination increases the plant grows more, perhaps due to the fact that light doesn't hit the plants directly.

0° inclination: these plants just grow a little because the plant was getting the light directly so that was bad. We moved the pots away from the light a bit and results improve slightly.

15° inclination: this plant grew much better because it was a little bit inclined, so the light didn't hit it directly to the plant so it grew a little more than 0° inclination.

30° inclination: this plant is more inclined. The plant has grown very good, and it is in a good state.

45° inclination: it has grown the best of all of our plants because the light does not hit directly (the same as 30° inclination) to the plant so that was good.

AMOUNT OF REGOLITH AND COCONUT FIBER

-The two best pots that have grown are from 45° inclination. One is 50% regolith and 50% coconut fiber and the other is 75% regolith and 25% coconut fiber.

-Of these two pots the best that has grown is 50% regolith and 50% coconut fiber.

In conclusion, we found that coconut fiber offered great nutrition to the plants and contradicted our hypothesis. Although some pots varied in growth at different time as shown in the graphs, we found that coconut fiber can be a great supplement for growth within our parameters.

We understand that many factors may have played a part in the problems that we had throughout the grow periods, but we are confident in the fact that inclination, rotation, and nutritional values can be of great benefit to the missions that embark towards Mars in the future.

We would like to thank all the teachers and students of the primary 5 year group, without their help and support, we wouldn't have had the opportunity to learn so much.

The following link leads to a Scratch application that we have developed for the purpose of inviting everyone to learn more about our work:

<https://scratch.mit.edu/projects/658316738>



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