To Grow or Not to Grow: Plant It Mars

Colorado Space Grant Consortium - Red Rocks Community College (Annie Strange, April Beal, Kayla Andis, Nick Pine)

ABSTRACT: Research shows that plants that undergo more stress have different priorities in growth and produce different fruits than plants that do not undergo stress. These differences have been determined by observing plants growing in different environments. The harsher the environment the more the plant tends to focus on the production of its fruit than the reproduction of the plant overall. Yet this difference of harsh versus ideal environments has yet to be tested on the seed itself undergoing different exposure conditions. High altitude balloon launches can help researchers expose seeds to near space conditions, similar to conditions on Mars, including extremely low temperatures, high levels of UV irradiation and low pressure. The effects of exposure on each seed can be studied by observing the growth and germination process of seed types that don't need pollination.

Hypothesis

Exposure to Mars-like condition will hinder germination of seeds. Seeds will undergo more damage during regular stratospheric conditions than during the event of a solar eclipse. Germination and plant growth will differ in simulated Martian soil versus Earth soil due to the difference in nutrient density and response to stress.

Inspired by the movie The Martian, this experiment simulates a breach in a habitat exposing seeds to extremely low temperatures, high levels of UV irradiation and low pressure. Exposing seeds to near space conditions using high altitude balloon launches can help determine if Mars could have successful plant growth.

A low-cost, uniquely designed payload provided a platform to expose a variety of seeds during a series of high altitude balloon flights and monitor the environmental exposure conditions. Seeds were placed in mesh panels attached to a spherical frame, with the environmental sensors suspended in the center. Seeds that do not need pollination were chosen being that if this experiment was carried out on Mars there would be no bees. The seed types were Kale, Broccoli, Cucumber, Radish, Cilantro and Carrot. Thanks to the design the seeds were exposed to call of the stratospheric conditions. After flight the seeds were planted in both Martian simulant soil and Earth soil. Each plant had an accompanied control to compare to. Using opportunities, such as, the eclipse on August 21st 2017, variables such as change in radiation exposure can also be tested as a contributing factor during exposure.

The technique being used in this study is the comparison between a control seed and a flown seed exposed to all conditions in the stratosphere for multiple plant species. The trend seen in the first two growth cycles indicates that the seeds exposed to Mars-like conditions germinate and fruit more quickly than the control seeds. Not all species are equally successful; the radishes, beans and carrots are the most hardy. The eclipse launch seeds growth cycle differs from the previous two cycles, indicating the effect of potential exposure differences. The seeds grown in Martian soil focus growth on fruit versus leaf production. The exposure seems to have jump started the reproduction stage of the plant. All plants tended to thrive in the Martian simulant soil. This experiment reproduced in large scale would progress this research.