The Growth of Moringa Oleifera Under Mars Conditions

Deanna DeMattio

Abstract

This study uses a deep water culture hydroponics system to evaluate how Moringa Oleifera grows under light conditions similar to those on the Mars surface. Moringa Oleifera is the most widely cultivated species of the genus Moringa, a very nutritious and antioxidant-rich plant with leaves containing the complete set of amino acids necessary for human nutrition. My research objective is to determine the leaf yield of Moringa Oleifera. Initially, the light received by the plants will be reduced to 590W/m2 which is comparable to the sun directly overhead at local noon on Mars. By using a enclosed hydroponic system there will be less water usage resulting in less evaporation. This is an ecosystem friendly structure that reduces waste and pollution from soil run off providing the capability to manage plant conditions for optimal growth.

Introduction

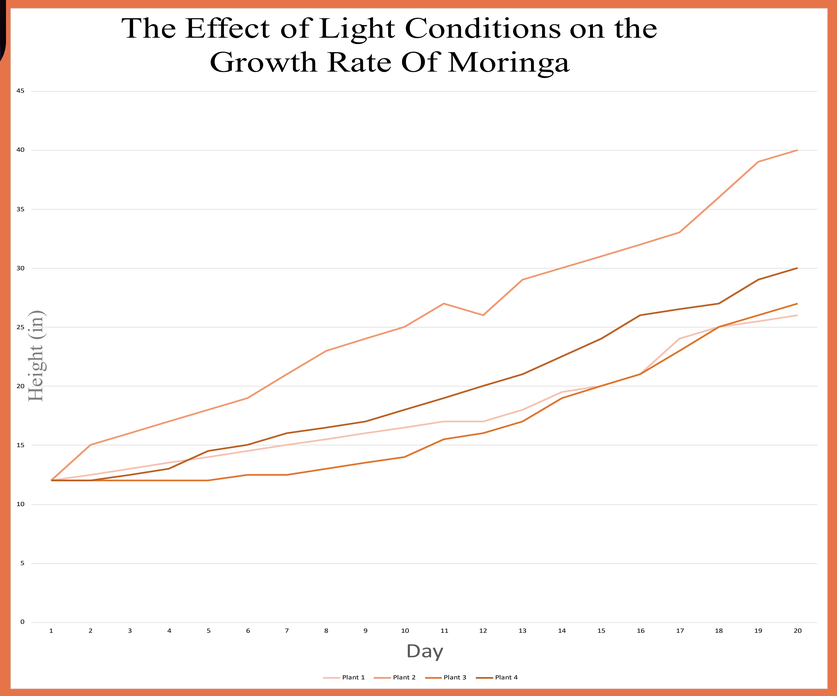
Outer space exploration has suggested that Mars could have the potential to be inhabited by man. A limitation to this, however, is the ability for Mars to provide the necessary nutrients to sustain human living. If sources that could provide such nutrients could be grown on Mars, however, then this may alleviate such an issue. The purpose of this research is to understand if a nutrient-rich plant could survive in Mars light conditions. Research has shown that humans can function off Moringa Oleifera. This plant is a nutrient rich super food plant that is native to the subtropical and tropical areas on Earth. To be able to grow this plant on Mars would show that humans could have the proper diet when Mars is settled. Using a hydroponics system is best for regulating the experiment because the amount of water nutrients, sunlight, temperature, and much more are held at a constant. I currently have approximately 30 plants growing in the hydroponics system.

Results

To determine the success of the plant the dry weight is measured during the harvest. The dry weight of the plant is used since plants have a high composition of water and the level of water in a plant is very hard to determine. The plants are dried in the dehydrator and the dry weight is used for the final leaf yield for that period.

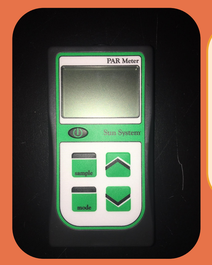
The data so far has shown that from going to Earths solar irradiance to Mars solar irradiance does not have a large effect of the growth of Moringa. The maximum solar irradiance of Mars is 590W/m2 compared to 1000W/m2 at Earths surface. The plants are currently receiving about 60% of the amount of light they had only a month ago and still producing great growth rates and leaf yields.

Date	Dry Leaf Weight (g)	Dry Stem Weight (g)
February 16, 2017	167.9	184.3
March 9, 2017	162.4	126.8
April 4, 2017	152.6	144.2



PH Meter

Measures the hydrogen ion activity in water, indicating its acidity or alkalinity. This measurement is taken daily and is held around a constant of 6.9 pH.



PAR Meter

Measures photo synthetically active radiation. The lights were placed so at any point in the system the meter read around 590W/m2 which is comparable to the suns solar irradiance at noon on Mars.

Dehydrator

To measure the dry leaf yield of the harvest. The harvest begins with cutting back the plant to around one to one and a half feet. Then the leaves and stems are separated by hand. The leaves and stems are weighed which is considered the wet weight. The plants are then laid in the trays and dehydrated for around seven hours. That dry weight is measured and will be considered the leaf yield for that period.

Conclusion

It is evident that Moringa Oleifera can sustain the solar irradiance on Mars. The next steps would be to change another factor that effects a plants growth such as the atmospheric composition. Mars atmosphere consist of mainly carbon dioxide, about 96%, creating an environment where there is an abundance of carbon dioxide would help show if the plant could maintain growth given its outside conditions. There is still more data being collected on the current research.

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