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INVESTIGATIONS INTO COTTON GROWTH ON THE MOON: EXTRAPOLATION OF GROWTH RATE FROM MICROGRAVITY SIMULATIONS AND EARTH GRAVITY

Abstract

As we progress towards human space exploration in the coming decades with all the necessary requirements for space travel, food comes to be one of the major contributors. As a civilization, humans have not just mastered the technique of agriculture in Earth but are extending towards plantation in microgravity and in other terrestrial systems. It is evident that the Moon planting of the China's Chang'e4 biosphere experiment is a laudable action. As seeds of cotton (Gossypium), oilseed rape, potato and Arabidopsis were carried to Moon along with fruit fly eggs and some yeast as an attempt to create a self-sustaining mini biosphere. The sprouting cotton seed on this lunar lander is the first ever plant to germinate on another world, heralding a new era for life in Moon. As it emerged that the cotton buds died as night fell on the 'far side' of the Moon; therefore, there is a need for more Moon simulations to be done on Earth to grow cotton seeds. In the light of this, as cotton will be an important seed for crew during long-term space missions for its versatility, performance and natural comfort. The aim of this project is to simulate microgravity environment to grow cotton seeds and to extrapolate the growth rate of cotton seeds for the Moon using the result derived from microgravity simulations and the Earth's gravity. The microgravity simulation was done using Clinostat at the Microgravity Simulations Laboratory of the Space Agency of Nigeria. The extrapolated result therefore gives a great idea and result into Moon farming. These simulations help to compare and analyze the growth rate of cotton plant which is necessary for humans in long duration space travel. The cumulative results are presented considering the growth rate of cotton plants in Earth environment, simulated microgravity and lunar gravity. Comparism of the result are done with the China's Chang'e4 biosphere experiment on the Moon. This will be helpful for the future Moon missions. In the end, suggestions are made for growing plants in various environments (such as Mars) that shall provide a pathway for future human settlements in space.