Paper ID: 74168
oral
student

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Life and Physical Sciences under reduced Gravity (7)

Author: Ms. Sucheshnadevi Patil
Humans In Space Inc. (HIS), United States

Ms. Krishna Bulchandani
India

A COMPREHENSIVE STUDY OF WATER RETENTION IN PLANT ROOT COMPONENTS IN MICROGRAVITY TO STRUCTURIZE MATHEMATICAL AND COMPUTATIONAL MATHEMATICAL AND COMPUTATIONAL MODELS FOR UNDERSTANDING PHYSICAL LAWS OF PLANT GROWTH

Abstract

We describe a method to alleviate water transport difficulties in plants in microgravity in a hydroponics setting in this work. Previous studies have shown gravitational potential as the driving mechanism for water transport from the roots to the leaf. In addition, water transport in plants in short-term microgravity circumstances during parabolic plane flights is influenced by gravitational potential. The pressure gradient required for pressure-driven bulk flow of water to the top of a plant through the xylem must be greater than the total of frictional resistance to water movement through the stem and the difference in gravity potential between the top and the roots. According to prior research, the fictitious resistance did not change in microgravity. As a result, a long-term experiment is required to investigate the effect of resistance under low gravity. Furthermore, because the water potential gradient between the leaves and the atmosphere is modest in the normally saturated conditions found in a closed plant culture facility with a high plant density, the gravitational potential is significant and cannot be ignored. This study's findings show that gravitational potential should not be overlooked in plant water transport. For lengthy periods of time, vigilance should be used in plants in low gravity conditions such as those on the Moon (one-sixth of of Earth's gravity), Mars (one-third of Earth's gravity), or the International Space Station (almost zero gravity) due to the shift in gravitational water potential. Furthermore, investigations have shown that there is no difference in gas exchange rates between ground and microgravity settings. However, no study has yet looked into the water vapor exchange between plants and the atmosphere in microgravity for extended periods of time. It is vital to research the influence of low gravity on water transport in plants in order to culture healthy plants for long periods of time and throughout several life cycles. In space, gravity's effect on water movement will be maintained. We will use laws of physics behind the biological mechanism of plants to construct mathematical and computational models using machine learning algorithms and simulate the microgravity environment and observe its effect for long duration space travel as well as future space habitation.