IAF SPACE EXPLORATION SYMPOSIUM (A3)
Space Exploration Overview (1)

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EMBRACING RESEARCH, DEVELOPMENT, AND INNOVATION IN SPACE FARMING - A BRAZILIAN EXPERIENCE

Abstract

Recently, the Brazilian Space Agency (AEB) and the Brazilian Agricultural Research Corporation (EMBRAPA) signed a protocol of intentions within the Artemis Project to undertake research, development, and innovation projects related to Space Farming. The initiative aims to support the pursuit of technological solutions for Space Farming, along with potential terrestrial applications. The resulting research platform - called Space Farming Brazil, comprises almost 40 researchers from 12 Brazilian research institutions and one US university. This interdisciplinary team envisions the program covering two main areas: space plant breeding and the development of modules for self-sustainable agricultural production systems tailored to lunar conditions. Initially, the focus will be on two plant species: chickpeas and sweet potatoes, selected for their nutritional value and adaptability to challenging environmental conditions. These species serve as crucial sources of high-quality protein and energy. Moreover, the presence of biofortified genetic materials, rich in antioxidants like anthocyanins, holds promise for maintaining human health during space missions by potentially mitigating the adverse effects of stressors such as ionizing radiation. Addressing the abiotic stress tolerance of crops on the Moon is a primary objective of the project's first phase. The aim is to overcome challenges posed by ionizing radiation, microgravity, high thermal amplitude, limited water availability in liquid form, and essential nutrient scarcity. Another goal

is to induce mutations in plants under space conditions to obtain genetic material better adapted to specific challenges, including those related to global climate change. Establishing initial colonies will require adaptations to controlled-environment agricultural production systems currently utilized on Earth. Key components include more efficient energy generation and storage systems, the development of biogenerative systems for space conditions, materials engineering, design, and prototyping for improved efficiency in area and water usage, the cultivation of genetic material suited to extreme stress conditions, automated systems to reduce astronaut workload, and the exploration of beneficial microorganisms for crop production in space environments. All program experiments will be carried out in accordance with international quality requirements.