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Author: Ms. Cassidy Brozovich
The Ohio State University, United States

Prof.Dr. Peter Ling
The Ohio State University, United States
Mr. Tyler Hatch
NASA Glenn Research Center, United States
Mr. John McQuillen
National Aeronautics and Space Administration (NASA), Glenn Research Center, United States

# DEMONSTRATION OF IN-SITU RESOURCE UTILIZATION OF LUNAR REGOLITH FOR PLANT GROWING SYSTEMS THROUGH SCALED CAPILLARY MODELS

**Abstract**

The development of reliable and bioregenerative crop growth production systems is vital for human exploration into deep space. As NASA prepares for the Artemis missions, scientists need to find a way to provide consistent and sufficient water delivery for all stages of a plant's life cycle. NASA has been able to successfully model flow through granular substrates, specifically a clay-based material arcilite, in 0-G. However, more studies need to be conducted to adapt the system for other substrates and incorporate how flow will change during each stage of plant growth. For future missions, payload requirements to support crop production systems will need to be limited, leading to the use of in situ resources, such as lunar regolith. Although numerous lunar regolith simulants are commercially available, few have been evaluated for their suitability in agricultural applications. First, a base regolith simulant will need to be identified based on its chemical and physical properties. Then, additional additives to improve the properties of the simulants to support plant growth will be identified. The design and composition of the substrate will be based on water transport requirements for different stages of plant growth. Scaled capillary models can be utilized to study surface-tension driven flows through various designer substrates to modify the physical properties of the selected regolith simulant. These models can accurately represent how flow will act in a reduced gravity environment, which can be used to design a full-scale facility for surface missions. This project will aid space researchers in the design of future crop production systems for surface missions by creating a refined model that can be used at all stages of plant growth and utilize in situ resources.