

RGB Imaging as a Tool to Monitor Indoor Crop Plant Production

Rachel Tucker¹, Blake Costine², Lillian Wang¹, LaShelle E. Spencer³, , Lawrence Koss², Aaron Curry⁴, Jason Fischer², Jennifer Gooden², Moon S. Kim⁵, Insuck Baek⁵, Jianwei Qin⁵, Isabella Pardo⁶, Kristine D. Wilson⁷, Matthew Mickens⁷, Gioia Massa⁷, Aubrie E. O'Rourke⁷

¹ Bennett Aerospace/LASSO II, KSC, FL ² Aetos Systems/LASSO II, KSC, FL, ³ Noetic Strategies/LASSO II, KSC, FL, ⁴ ERC/LASSO II, KSC, FL, ⁵ Environmental Microbial and Food Safety Laboratory, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, MD, ⁶ OSTEM Internship Program, KSC, FL ⁷ NASA Exploration Research and Technology, KSC, FL

Future crop production in space will require robust monitoring technologies that can optimize crop yield, reduce waste, and generate data for an automated plant growth design. Imaging has been suggested as a tool for measuring plant health, yet imaging systems for indoor crops have not been tested in spaceflight. Fortunately, RGB images of crop plants growing inside the Advanced Plant Habitat (APH) aboard the ISS have already been captured. In ground-based studies, the Kennedy Space Center (NASA, KSC) is collaborating with the United States Department of Agriculture (USDA ARS) to develop an imaging system for monitoring indoor crop plant health. In one study, we applied a drought stress to ‘Dragoon’ lettuce plants over a period of 14 days and captured RGB images in 24 h increments. Images were analyzed, and by applying a difference index, the images were able to be used to detect the drought stress in lettuce. This difference index was then applied to RGB images collected inside the APH ground unit for a pre-flight experiment growing ‘Outredgous’ lettuce under different substrate moisture conditions, and results showed that the RGB camera was capable of detecting drought stress inside the spaceflight plant growth hardware. These results suggest that RGB cameras already deployed to space may offer valuable information for monitoring plant production in extraterrestrial environments. This research was supported by NASA’s space biology program.