IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (A1)
Interactive Presentations - IAF/IAA SPACE LIFE SCIENCES SYMPOSIUM (IP)

Author: Dr. Christina Johnson
United States, christina.m.johnson@nasa.gov

Dr. Lucie Poulet
Université Clermont Auvergne (UCA), France, lucie.poulet@uca.fr
Ms. LaShelle Spencer
United States, lashelle.e.spencer@nasa.gov
Mr. Matthew Romeyn
NASA, United States, matthew.w.romeyn@nasa.gov
Mr. Lawrence Koss
United States, lawrence.l.koss@nasa.gov
Mr. Jacob Torres
United States, jacob.j.torres@nasa.gov
Ms. Jennifer Gooden
United States, jennifer.l.gooden@nasa.gov
Dr. Mary Hummerick
United States, mary.e.hummerick@nasa.gov
Ms. Haley Boles
United States, haley.o.boles@nasa.gov
Dr. Oscar Monje
United States, oscar.a.monje@nasa.gov
Dr. Gioia Massa
NASA John F. Kennedy Space Center, United States, gioia.massa@nasa.gov
Dr. Raymond Wheeler
NASA John F. Kennedy Space Center, United States, raymond.m.wheeler@nasa.gov

EVALUATING MICROGREENS CROP READINESS FOR SPACE PRODUCTION

Abstract

Microgreens are small-size, nutrient-rich, and fast-grown crops, which are considered as candidates for future space exploration missions. In particular, the ISS, the Lunar Gateway, and Mars and Lunar missions could benefit from growing microgreens to supplement astronaut diets in the near future. Research at NASA's Kennedy Space Center has focused on (1) the selection of microgreens compatible species, (2) the evaluation of microgreens food safety, (3) the use of passive wicking, on-demand watering, and hydroponics cultivation, (4) simulated microgravity growth, (5) microgreen canopy gas exchange, and (6) harvesting techniques in microgravity. This interactive presentation summarizes this research. Microgreen species will be evaluated for their yield in relationship to the quantity of inputs – water, seeds, substrate, light intensity, photoperiod, crew time – required for their growth; for their organoleptic and sensory factors in order to down select species that are highly acceptable for humans; and for their microbial loads as detected in their growth environment and the food safety metrics of their edible tissue. Passive wicking, on-demand watering, and hydroponic systems are being studied as an efficient way to deliver essential nutrients and water to microgreens, included in a microgravity environment. Growth studies in simulated microgravity

(using 3-dimensional clinostats) will assess microgreens growth relative to that in 1g. Gas exchange studies on microgreens canopies in various airflows will assess their photosynthesis and transpiration. Finally, a series of parabolic flights has enabled the evaluation of different harvesting and bagging techniques in microgravity. Indeed, traditional plant harvesting methods (scissors) in microgravity could generate significant microgreen debris in the space station cabin. Two innovative techniques, coupled to a dedicated bagging method, were designed and evaluated against the control, traditional, harvesting technique. This research was supported by grants from NASA KSC's Independent Research and Technology Development Program, NASA's Flight Opportunity Program, NASA Postdoctoral Program Fellowships (L.P. C.J.) supported by NASA's Space Biology program, and support from NASA's Human Research Program.