

DESIGN OF ROOT MODULES FOR A LUNAR SALAD MACHINE

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Deployment of a small-scale plant growth system, or “salad machine” during a Lunar outpost mission provides an opportunity for testing bioregenerative subsystems for future missions to Mars. The production of even small amounts of fresh foods could improve the dietary diversity and supply bioavailable antioxidants to combat effects of radiation. A simple salad machine consists of a light cap and a root module. Designing and optimizing rooting modules for the plants will be key to avoiding plant stress and supplying physical support, nutrients, water, and O₂ to roots. An initial step will be to assess whether conventional hydroponic approaches are more efficient than soil-based systems that incorporate lunar regolith. Hydroponic systems typically require active pH control, replenished nutrient solutions, and recirculation. On the other hand, substrate-based root modules would require moisture sensing and control, and procedures for incorporating composted wastes and any missing nutrients. Key issues would include comparing plant yields, power use, system mass, and crew time for maintenance of the different systems, in addition to demonstrating the ability to sustain plant growth over successive generations. If regolith amendments prove cost effective, plant growing efforts would need to integrate closely with in situ resource utilization and waste recycling systems to accommodate long duration Lunar habitats and demonstrate Mars-forward concepts for growing plants.