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SPACE GARDENING LESSONS FROM HI-SEAS: LIGHTS, CROPS AND GROWING MEDIA

**Abstract**

The Hawaii Space Exploration Analog and Simulation (HI-SEAS) project is an experiment in long-duration isolating effects on the crew of a future Mars mission. Long duration human space travel, such as a mission to Mars, will require some sort of means to produce food and recycle organic waste along the way. Extreme sustainability, low waste production, recycling and reuse of materials will be critical. An indoor gardening project was begun by HI-SEAS Crew II, with a focus of wavelengths of light for indoor gardening, and impact on crew happiness. Crew III continued this study on their 8-month mission, focusing on minimizing cost and resource consumption, and expanding the size and variety of the garden over time. Composting was a crucial addition to the garden expansion.

To maximize the amount of plant life grown in the HI-SEAS habitat, the crew employed lighting from both high-end LEDs meant for indoor gardening (from HelioSpectra and HELIAC), off-the-shelf decorative LEDs, desk lamps, and natural light from one of the two windows. Food waste from the kitchen was anaerobically composted, a method known as Bokashi composting. This process produced both fertilizer and allowed the crew to expand the amount of soil in the garden by an extra 10 gallons. The crew also made use of several types of growing media: soil, hydroponics, and aquaponics.

This paper discusses the benefits and drawbacks of the light sources used, the success and failures with each type of plant grown in the HI-SEAS habitat, and the success and failures of each of the gardening methods employed in the habitat.

A large variety of plants were successfully grown in the garden: three types of lettuce, two types of tomatoes, green onion, dill, basil, parsley, cilantro, carrots, wheat grass, sunflower spouts, pak choi, as well as decorative flowers. At the end of the mission, the crew conducted a survey providing feedback on what they enjoyed most about the garden, what they disliked, and recommendations for future improvements.