

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

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HEALTH OF AN AQUAPONIC SYSTEM IN A LOW EARTH ORBIT PHOTOPERIOD

Abstract

Circadian rhythms are the ongoing biological rhythms about a period of a day, or 24 hours (Dunlap et al., 2004). Light and temperature are zeitgebers, which affect the circadian rhythm (McClung, 2006). The timing, duration, pattern, and history of exposure of light is what determines the circadian clock for an organism. (Lockley, 2009). It has been studied that organisms can adjust to different light cycles (Devlin Kay, 2000), given several days for adjustment period (Nagy, Kay, Chua, 1998). The objective of this investigation is to mimic the photoperiod similar to that experienced on the ISS, 45 minutes light and 45 minutes dark, and observe the effect it has on an aquaponic system. An aquaponic system is a closed system, which recirculates water from fish culture, onto plants grown hydroponically and back to the fish as clean water. The system depends on a biofilter, which serves to convert ammonia into nitrate. The duration of the investigation will last 40 (Earth) days. Once a day, the pH and dissolved solids will be measured. Every five days, nitrate level will be measured. Healthy aquaponic systems maintain very stable water chemistry. If swings are observed throughout the investigation period, it will mean that the photoperiod does have an effect on the health of the aquaponic system. If significant results are observed, further investigations must be made to isolate each biotic factor specifically, to determine if each one is equally affected by the 45 minute photoperiod. This research is important to evaluate the practicality of developing inflatable, transparent, greenhouses, which would remain in low Earth orbit.