

Life Sciences as Related to Space (F)
Space Food and Nutrition (F4.5)
Consider for oral presentation.

THE MICROBIOME OF A GREENHOUSE FOR GROUND DEMONSTRATION OF PLANT CULTIVATION TECHNOLOGIES IN SPACE

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The EDEN ISS greenhouse is a confined mobile test facility in Antarctica for the development and optimization of new plant cultivation techniques for future space programs. The EDEN ISS greenhouse was in operation from February to November 2018 for fresh food production for the overwintering crew at the German Antarctic Neumayer III station. During the nine months of operation, samples from the different plants, from the nutrition solution of the aeroponic planting system and from diverse surfaces within the three different compartments of the container were taken (future exploration greenhouse, service section, cold porch). Quantity as well as diversity of microorganisms was examined by cultivation. For identification, 16S rRNA gene sequencing was performed for the isolated prokaryotic organisms. In case of the plant samples, microbial quantities were in a range from 10² to 10⁴ colony forming units per gram plant material. Compared to plants purchased from a German grocery, the produce hosted much more microorganisms than the EDEN ISS plants. The EDEN ISS plant samples contained mainly fungi and a few, most probably harmless bacteria. Most likely due to the used cultivation approach, Archaea were not found in the samples. The bioburden in the nutrition solutions increased constantly over time but never reached critical values. The surface samples revealed high differences in the microbial burden between the greenhouse part of the container and the service section and cold porch part. However, the numbers of organisms (bacteria and fungi) found in the planted greenhouse were still not critical. The microbial loaded surfaces showed strong temporal as well as spatial fluctuations. In samples of the nutrition solution and

the surface, the amount of bacteria exceeded the amount of fungi by many times. The most abundant bacterial phyla were Firmicutes and Actinobacteria. These phyla include plant- and human-associated bacterial species. In general, there is a low risk of infection due to microbial contamination according to the results of this study. The metagenomic analysis of the EDEN-ISS samples is ongoing.