From space to Antarctica: plant testing to support crews in extreme environments

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Crews stationed in “ICE” – isolated, confined, and extreme – locations like on the International Space Station and at polar research stations do not have regular access to plants or fresh fruits and vegetables. Including plant growth systems in these stations can supply the crew with fresh produce while also serving as research and testing platforms for a diverse range of science and engineering topics including genetics, physiology, horticulture, hardware and software development, food safety, and crew psychology. One such platform was EDEN ISS, which was a plant production facility located at the German Antarctic research station, Neumayer Station III (NM-III), from 2018-2022. As a collaboration between the German Aerospace Center (DLR) and NASA, the main goal of EDEN ISS was to deploy and test a full-scale system in an extreme environment in order to better understand the requirements for designing and operating space crop systems in future exploration-class missions. Throughout their 14-month overwintering expeditions, the crews at NM-III grew their own fresh fruits and vegetables in aeroponic hardware. In addition to the science and engineering campaigns from EDEN ISS that have already produced novel findings, Antarctica serves as a stark teacher and reminder that what we learn from real-scenario testing can include far more than the initial research objectives.