Exploring Sustained Food Production in the Veggie Vegetable Production System

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Since 2014, the Veggie vegetable production system on the International Space Station has intermittently supplied astronaut crews with fresh produce. To assess the potential for continuous crop production in Veggie and develop a baseline for future space crop production systems, a 120-day study was conducted to determine methodology for inputs, optimal yield, food safety standards, and crew involvement. 'Amara' mustard and 'Red Russian' kale were grown as initial crops, followed by 'Extra Dwarf' pak choi and shungiku as final crops. Previous grow-outs in Veggie have included harvests at 28-35 days after initiation. In this study, a 56-day grow-out with multiple harvests from the same plants was compared to the conventional, single harvest Veggie schedule. Unlike previous Veggie studies which grew all plants simultaneously, this test staggered initiation and harvest, aiming for consistent and increased production. Plant pillows were initiated in pairs weekly and positioned to reduce shading. Completed pillows were immediately replaced with fresh ones. The multi-harvest scheme used fewer pillows, totaling 46% less pillow mass than the single harvest method. Yield varied by crop and harvest scheme, when compared as fresh edible biomass production across 56-day time increments. 'Red Russian' kale yielded similarly across harvest schemes. In the multiple-harvest schedule, 'Amara' mustard and shungiku yielded 23% to 25% higher, respectively, while 'Extra Dwarf' pak choi had 43% lower yield. Microbial analysis of the plants indicated no culturable human pathogens. Microbial load of a given plant appeared to depend more on system age than plant age; across harvest methods, aerobic plate counts from final crops were higher than those of initial crops. This project also considered the complexity of crew involvement in a continuous production scenario. New crew procedures that periodically remove plant material from the Veggie root mat would be needed under continuous production to prevent potential pathogens and unpleasant odors. This study supports future space crop production scenarios and was funded by NASA's Human Research Program.