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Growth of Three Lettuce Cultivars In Nasa's HDU PEM During the 2010 DRATS Test

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NASA's 2010 Desert Research and Technology Studies (DRATS) of the VEGGIE Food Production System in the Habitat Demonstration Unit (HDU) Pressurized Excursion Module (PEM) was the first operational evaluation of salad crop production technology in a NASA analog test. Rooting media and slow release fertilizers were evaluated for three lettuce cultivars that had shown promise as candidates for a surface based food production system. These tests involved comparing growth, color and quality of the lettuce cultivars grown under VEGGIE LED array (Orbitec, Madison, WI) or Biomass Production System for Education {(BSEe), Orbitec, Madison, WI) compact fluorescent lamps using a gravity feed water delivery system. Mission relevant conditions of CO_2, temperature and RH were maintained using controlled environment chambers (EGC, Chagrin Falls, OH). Growth data was obtained for the two red leaf lettuce cultivars, Outredgeous and Firecracker, and the green Bibb lettuce cultivar, Flandria. Growth and quality was evaluated using different concentrations (7.5 g/L and 15g/L) of commercial slow release fertilizer (Osmocote Plus 15-9-12, Scotts, Maryville, OH) and Nutricote 18-6-8 (Florikan, Sarasota, FL) in either a peat/vermiculite media (sunshine LP5 Mix, Sungro, Bellview, WA) or calcined montmorillonite clay [(arcillite,)Turface Proleague, Profile LLC, Buffalo Grove, IL]. The commercial peat/vermiculite mix generally resulted in larger plants than those grown in arcillite. Increasing the concentration of Osmocote from 7.5 to 15 g/L increased the height, dry mass, and leaf area of lettuce cultivars. In contrast, there was a decrease in growth parameters when concentration of Nutricote was increased from 7.5 to 15 g/L. The best growth was obtained with the 7.5 g/L Nutricote using a commercial peat/vermiculite mixture. This media was used for field testing VEGGIE plant system in the 2010 DRAT test. The VEGGIE nutrient delivery system worked well, was able to be maintained by multiple operators with a minimum of training, and supported excellent lettuce growth for the duration of the 14-day test. The operational DRAT field testing in the HDU identified light quality issues related to morphology and pigment development that will need to be addressed through additional testing. Feedback from the crew, ground support personnel, and human factors leads was uniformly positive on the psychological value of having the crop production system in the pressurized excursion module. Data are being used to design a plant atrium with LED lighting to evaluate salad crop growth during NASA's 2011 DRATS test.