Investigating Microbiome Differences between Red Romaine Lettuce Grown from Sanitized and Unsanitized Seeds

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INTRODUCTION

• The International Space Station (ISS) as an integral component for the discovery and development of advanced robotics, materials, communications, medicine, agriculture, and environmental science due to it currently being the world’s only microgravity laboratory of its kind.2

• Because the ISS is a contained system with confined quarters, much research has been undertaken to assess and diminish the number of microbiological risks associated with astronauts inhabiting the station for extended periods of time. Notable microbiological risk factors include drinking water, air, and food.3

• As an avenue for both mental/emotional respite and a source of fresh produce for astronauts, a vegetable production system has been employed on the ISS.1

• In order to understand the microbial risks involved with a “pick and eat” vegetable system on the International Space Station (ISS), this study aims to compare microbial differences between sanitized and unsanitized seeds by tracking and identifying seed-borne microbes throughout the development of red romaine lettuce (Lactuca sativa)—a plant species that has already been grown on the ISS.

METHODS

• ISS conditions (excluding microgravity) were simulated in a growth chamber (relative humidity RH 50%, temperature 23 °C, and CO2 3000 ppm).

• Leaf and root tissue samples were taken from plants germinated with sanitized and unsanitized seeds at day 7 and 14.

• Heterotrophic plate counts on selective media and genetic sequencing were used to quantify and identify microorganisms present on the developing plants (days 7, 14, 21, and 28).

• Inoculum from leaf and root samples were cultured in duplicate onto tryptic soy agar (TSA) plates for quantification, and each sample was characterized using the ISS rRNA gene and next generation sequencing (NGS).

• Sequencing was analyzed using GreenGenes software and diversity levels were determined.

• Similarities and differences in the community structure were determined by comparing the sanitized and unsanitized seeds and plant tissue throughout the time course study

RESULTS

DISCUSSION

Roots display significant increase in bacterial growth from day 7 to day 14 of plant growth, as well as a significant difference in bacterial growth between sanitized and unsanitized roots at days 7 and 21 (Fig. 1).

Colothrix occupied the majority of all genus sequencing reads, for both sanitized and unsanitized at day 7 and day 14. This is not entirely surprising as Colothrix may be present in a symbiotic relationship with plants.

Sanitized and unsanitized samples possessed much of the same bacterial genera—the exceptions being Enterobacter in sanitized samples and Burkholderia in unsanitized samples.

Thermogemmatispora was identified more frequently on day 14 of both treatments, this could be indicative of competition between genera.

Pseudomonas was identified in both treatments. It was identified more frequently on the day 7 sanitized leaves before dropping on day 14; conversely, Pseudomonas identification on day 7 unsanitized leaves was less than on day 14.

REFERENCES

1.00E+10

1.00E+08

1.00E+09

1.00E+10

• I gained invaluable knowledge, connections, and experience in my time at NASA’s Kennedy Space Center, and I can genuinely say this has been the opportunity of a lifetime.

• Participating in this incredible internship has augmented my desire to pursue a career in scientific research, as such I have immediately started to explore and apply to equally amazing research experiences.

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