

Fiscal Year:	FY 2021	Task Last Updated: FY 03/16/2021	
PI Name:	Jinkerson, Robert Ph.D.		
Project Title:	Evaluation of Small Plants for Agriculture in Confined Environments (SPACE) Tomatoes for Space Flight Applications		
Division Name:	Space Biology		
Program/Discipline:			
Program/Discipline-- Element/Subdiscipline:			
Joint Agency Name:		TechPort:	No
Human Research Program Elements:	None		
Human Research Program Risks:	None		
Space Biology Element:	(1) Plant Biology		
Space Biology Cross-Element Discipline:	None		
Space Biology Special Category:	(1) Bioregenerative Life Support		
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Comments:			
Project Type:	FLIGHT	Solicitation / Funding Source:	2018 Space Biology (ROSBio) NNH18ZTT001N-FG2. App D: Flight and Ground Space Biology Research
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No. of Post Docs:		No. of PhD Degrees:	
No. of PhD Candidates:		No. of Master' Degrees:	
No. of Master's Candidates:		No. of Bachelor's Degrees:	
No. of Bachelor's Candidates:		Monitoring Center:	NASA KSC
Contact Monitor:	Massa, Gioia	Contact Phone:	321-861-2938
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Flight Program:	ISS		
Flight Assignment:			
Key Personnel Changes/Previous PI:			
COI Name (Institution):	Orozco-Cardenas, Martha Ph.D. (University of California, Riverside)		
Grant/Contract No.:	80NSSC21K0578		
Performance Goal No.:			
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Task Description:	<p>Plants can have a tremendous beneficial impact on long space flights if some biological hurdles can be overcome. Plants on extended space expeditions can provide a fresh source of food and nutrients, CO₂ uptake capacity, and behavioral health benefits to crewmembers. Most fruit and vegetable bearing plants, however, are too large and produce too much inedible biomass to be part of a bioregenerative life support system. We have recently increased the developmental rate and harvest index of tomato plants dramatically through genetic engineering. These plants rapidly progress through their developmental cycle to produce fruit, minimizing their size and producing little non-fruit biomass. We are calling this extremely dwarf phenotype Small Plants for Agriculture in Confined Environments (SPACE) tomatoes. These plants have been evaluated on Earth but it is not known how this dwarf plant phenotype will manifest in a microgravity environment.</p> <p>This project aims to (1) cultivate SPACE tomato plants in the Advance Plant Habitat onboard the International Space Station (ISS); (2) determine the physiological response of these plants to growth in microgravity; (3) evaluate fruit grown on the ISS for yield, nutrient levels, and microbial loading; and (4) complete a full life cycle of the SPACE tomatoes onboard the ISS and determine if growing tomatoes seed-to-seed in space alters fruit yields of progeny.</p> <p>The SPACE phenotype is innovative and potentially transformative for space flight and ground-based controlled environment agriculture. The SPACE tomato is uniquely suited for environments where physical space is limited. Relatively little research has been done on producing plant traits such as SPACE tomatoes because they serve little agricultural importance in present day ground-based agricultural systems. Most other mutations that produce plants dwarfs largely keep the proportion of leafy, un-edible material to edible fruit the same. NASA has investigated several dwarf tomatoes but none have been as extreme as the SPACE tomato. The SPACE trait forces the plant quickly through its developmental cycles to produce fruit without the necessity to develop the whole plant. This results in profoundly small plants that produce fruit that is a high fraction of their biomass. This work will determine how well-suited SPACE tomatoes are for a bioregenerative life support system. Morphological data of SPACE tomato plants grown in microgravity will also inform future plant genetic engineering strategies on how to create other dwarf plant varieties that are ideally suited for growth on a spacecraft in microgravity.</p>
	Rationale for HRP Directed Research:
	Research Impact/Earth Benefits:
	Task Progress: New project for FY2021.
	Bibliography Type: Description: (Last Updated: 07/05/2023)