Fixing N_2 and Growing Food for Manned Missions to Deep Space

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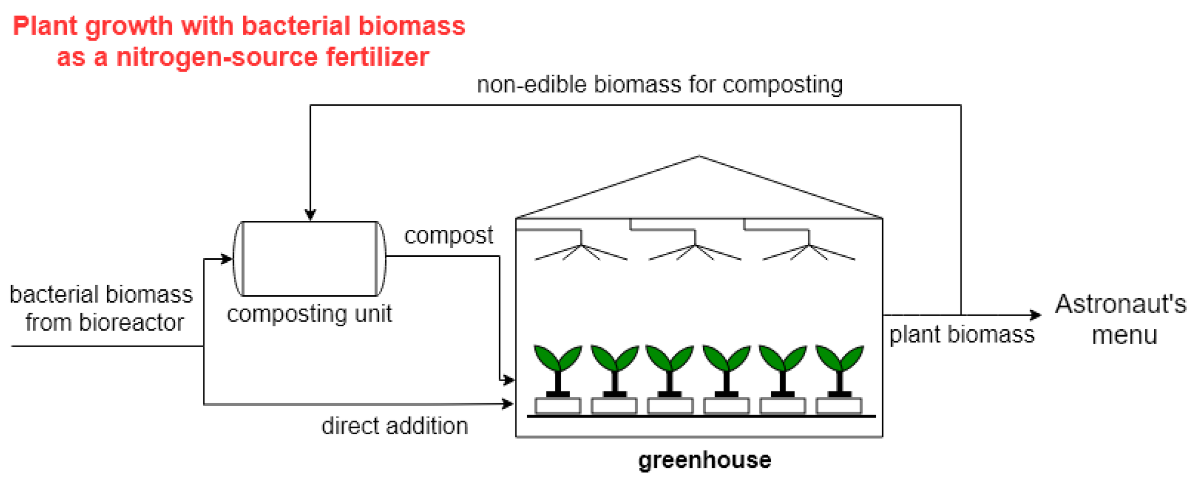
Introduction

- Food production to support manned missions to deep space requires *in situ* dinitrogen fixation.
- Using biomass of *R. palustris* instead of *A. vinelandii* results in 300% higher acetate-to-biomass conversion rates.
- Composting of bacterial biomass prior to plant amendments may enhance plant yields.
- We propose to grow *R. palustris* biomass in a continuously-operated 3-L bioreactor and test plant growth with bacterial supplements.

The Approach

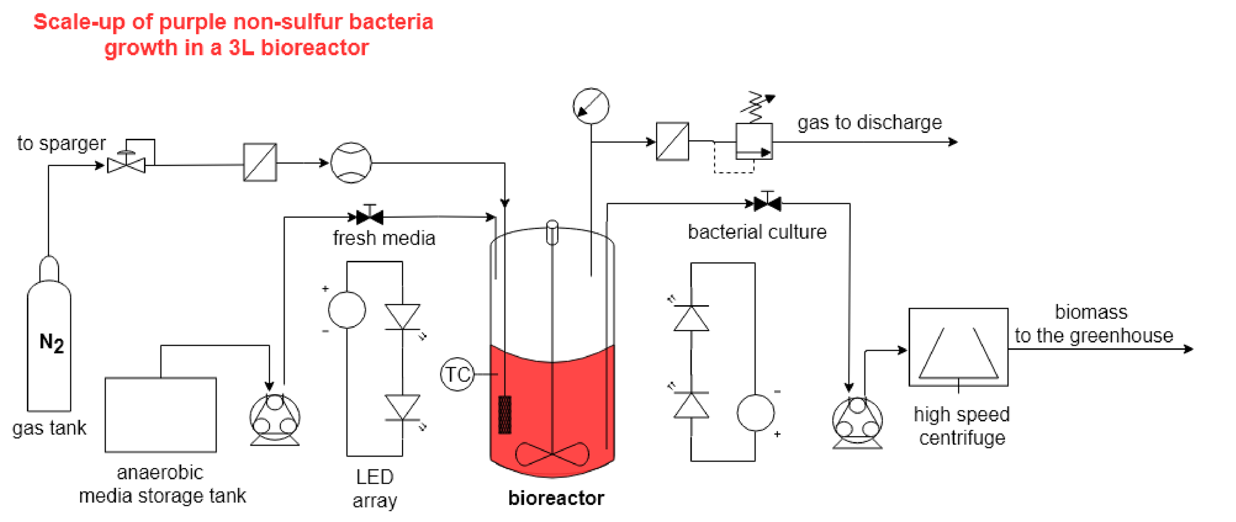


Addition of *A. vinelandii* grown with N_2 to plant hydroponic solution improves plant yield compared to control (without bacterial biomass).

Future steps and details:

- Assemble a 3L photobioreactor, with a constant supply of N_2 gas.
- Generate sufficient biomass for plant and compost trials.
- Calculate and measure N transfer efficiency from bacterial to plant biomass.
- Compare plant N uptake efficiency with or without prior composting.

Flow chart of the proposed photobioreactor operation:



Average plant weight (g) at harvest in the different treatment groups

Treatment	Average total wt (g)		Percent increase	
	Fresh wt	Dry wt	Fresh wt	Dry wt
+N+B	33.69	4.74	129.01	102.02
+N-B	14.71	2.35		
-N+B	21.96	3.82	637.00	356.89
-N-B	2.98	0.84		

Acknowledgements

This material is based upon work supported by the National Aeronautics and Space Administration (NASA) under grant or cooperative agreement award number NNX17AJ31G. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NASA.

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