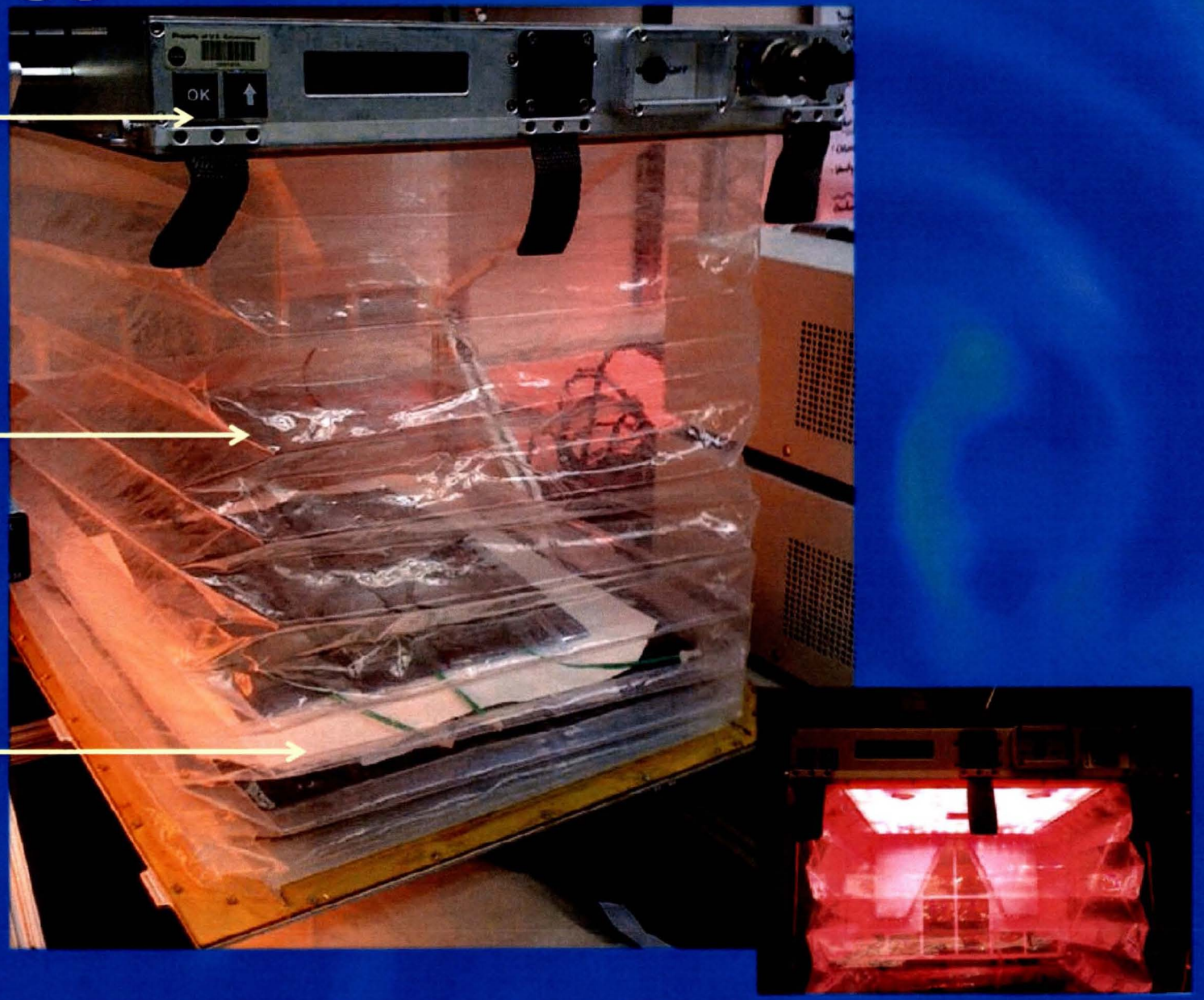
Media Effects on Lettuce Growth in Rooting "Pillows" Designed for the Veggie Spaceflight Growth Chamber

Gioia Massa[1], Gerard Newsham[2], LaShelle McCoy[2], Gary W. Stutte[2] and Raymond M. Wheeler[1]

1. Surface Systems Division, Mail Code NE-S-1, Kennedy Space Center, FL 32899

2. ESC Team QNA, Mail Code ESC-24, Kennedy Space Center, FL 32899

Veggie Plant Growth Unit



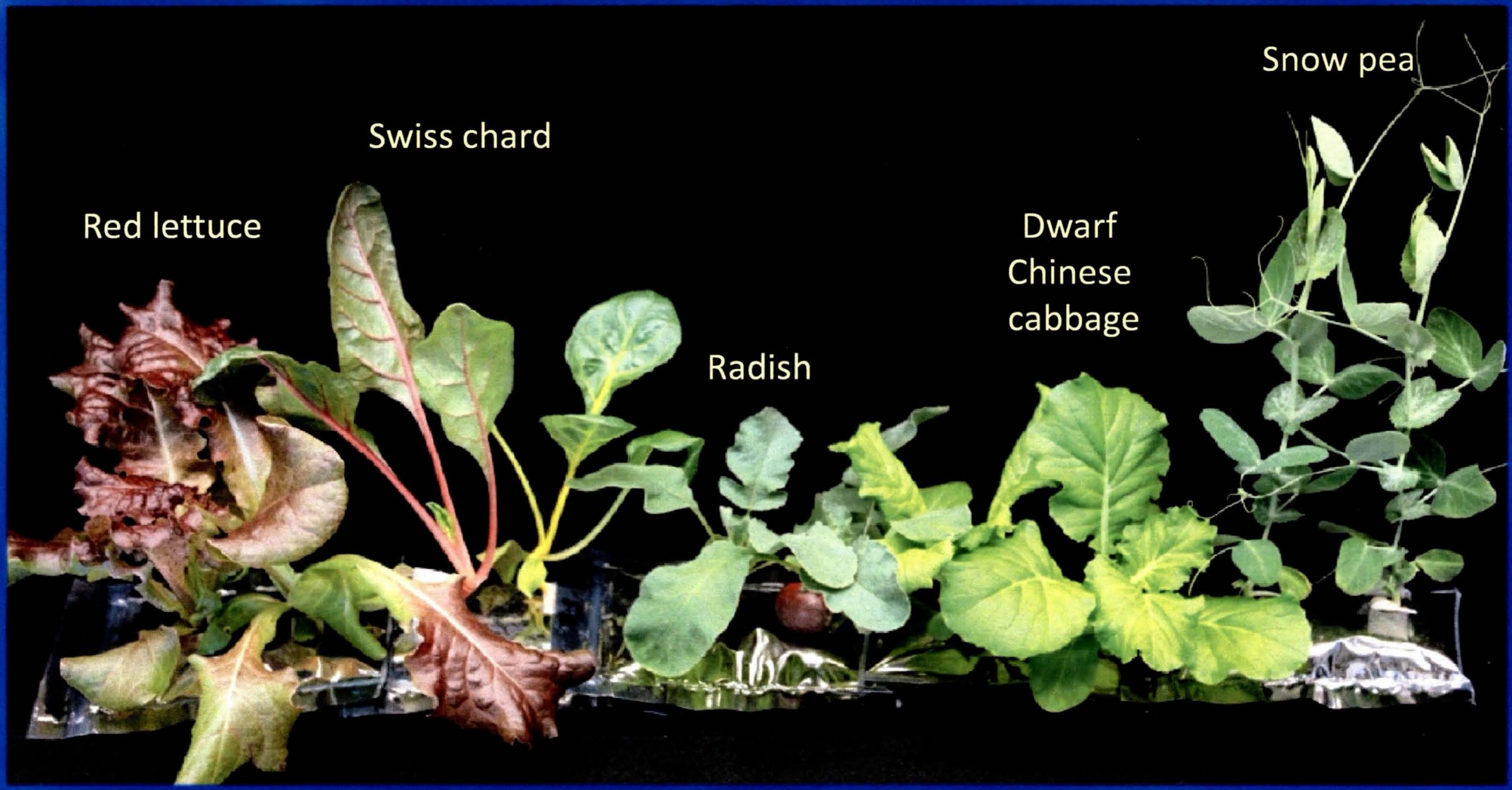
Designed and built by Orbital Technologies Corporation (ORBITEC)

Rooting Pillow Concept

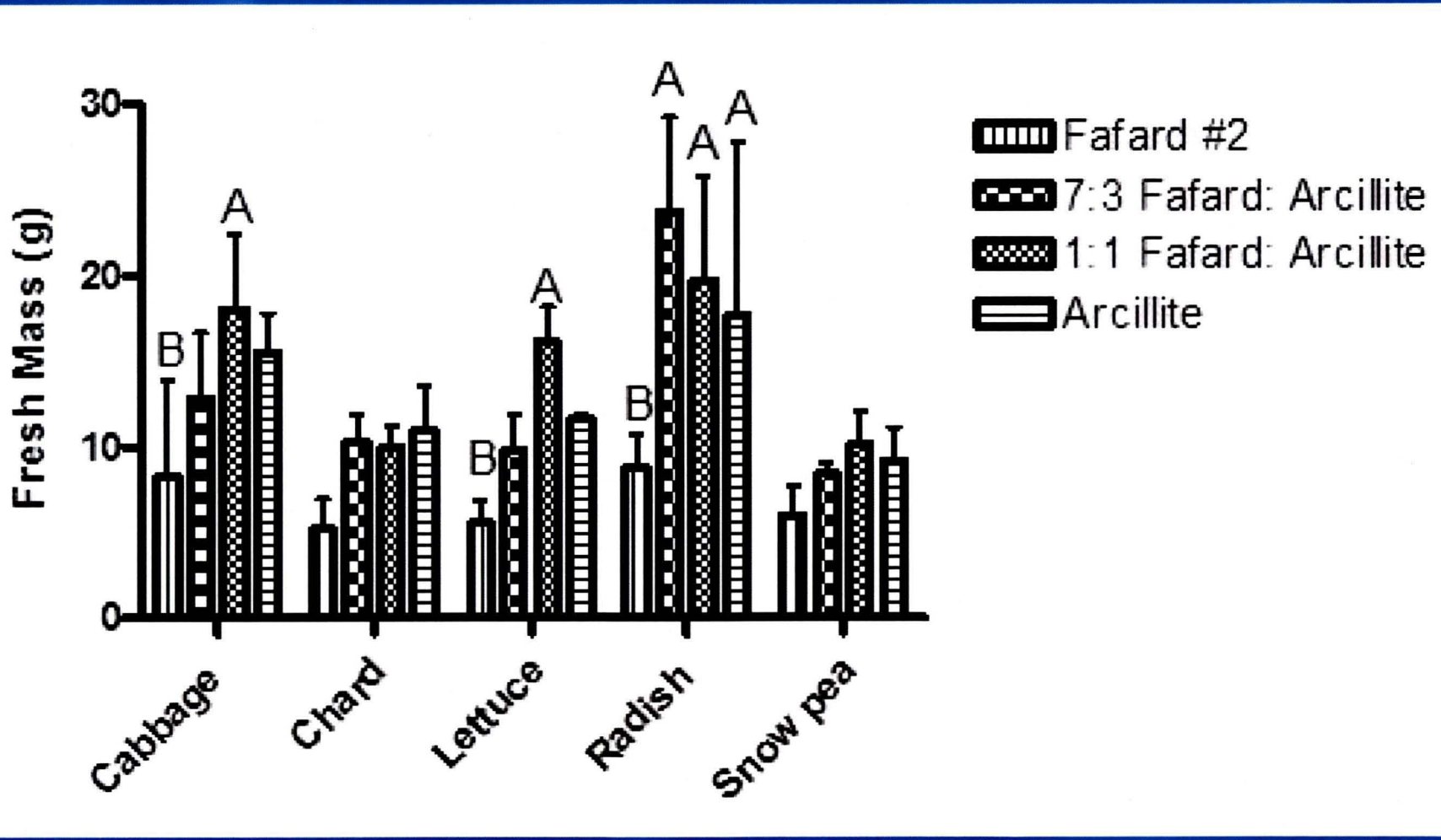
- Configurable for large variety of plant types (1, 2, 3, 6)
- Media and fertilizer contained
- Plant seeds dry, in 1 g
  - Low launch mass
- Hydrate on orbit
- No energy
  - Passive wicking from reservoir
- Minimal crew time
- Designed for single use
  - Dispose after harvest
- Reduces sanitation requirements

Prototype flight pillow courtesy of ORBITEC

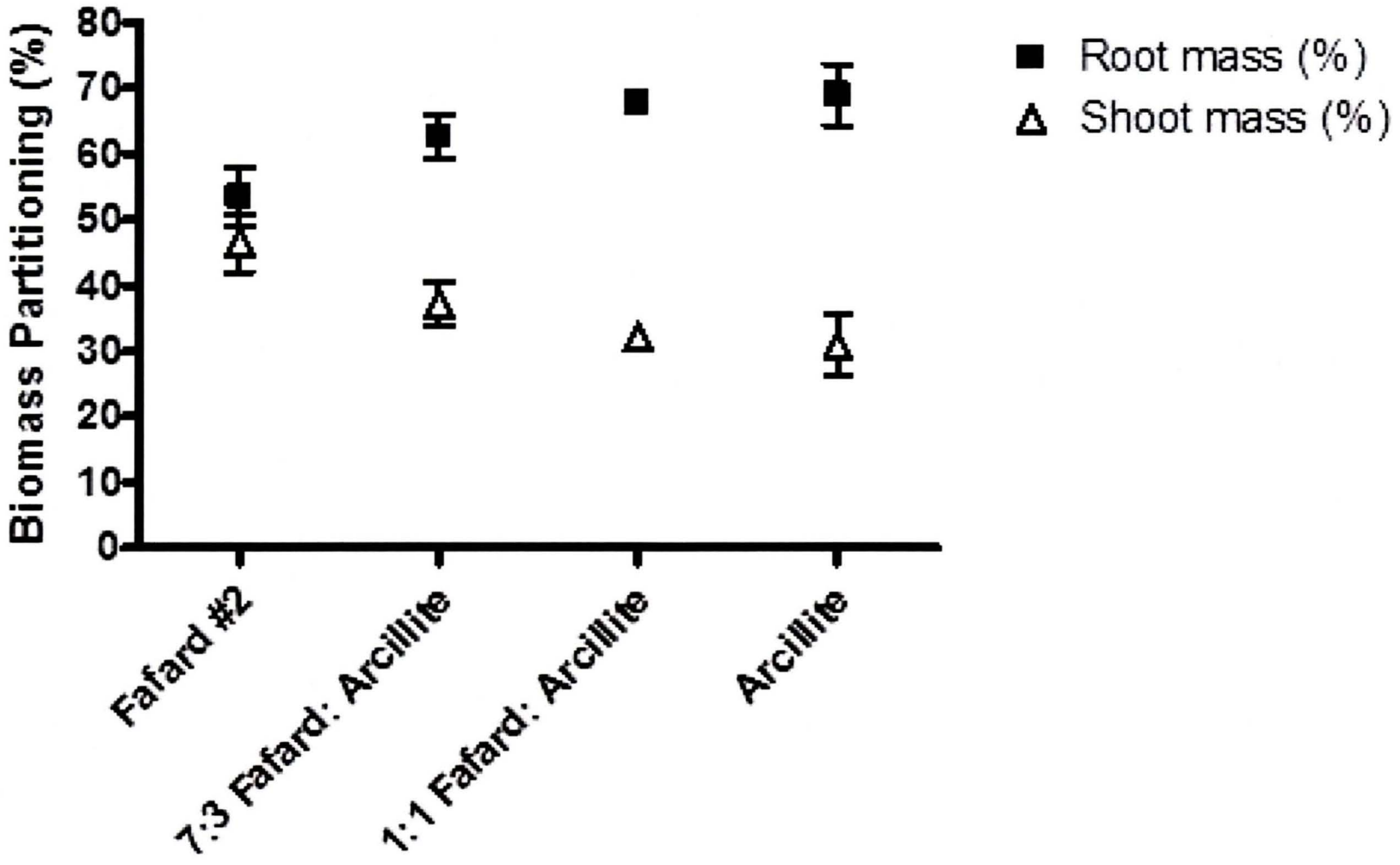
Examples of species tested in pillows



Yield strongly altered by media across different species



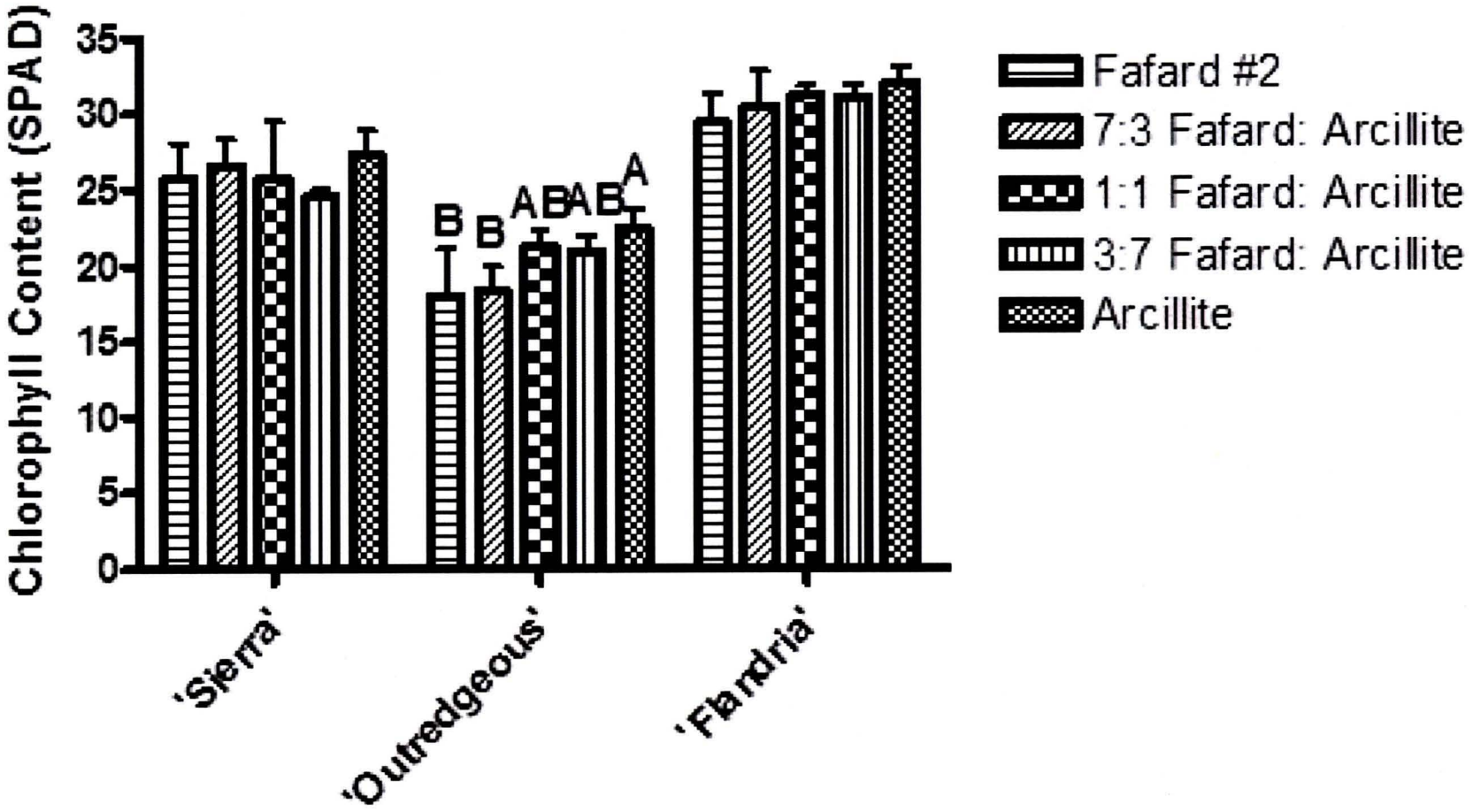
Media also effects biomass partitioning in Radish



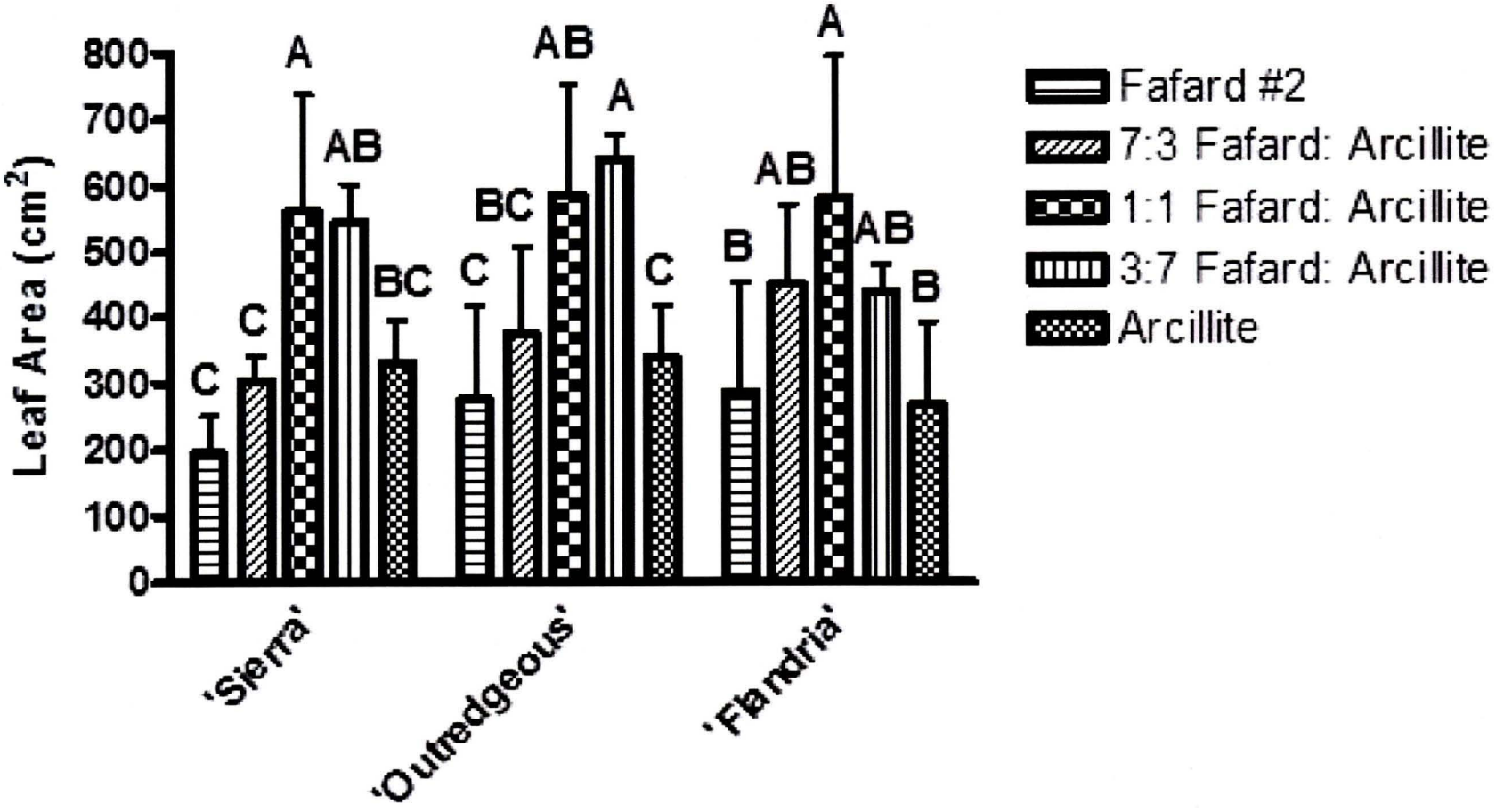
Lettuce shows a response spectrum

100% Arcillite ⟷ **100% Fafard #2**

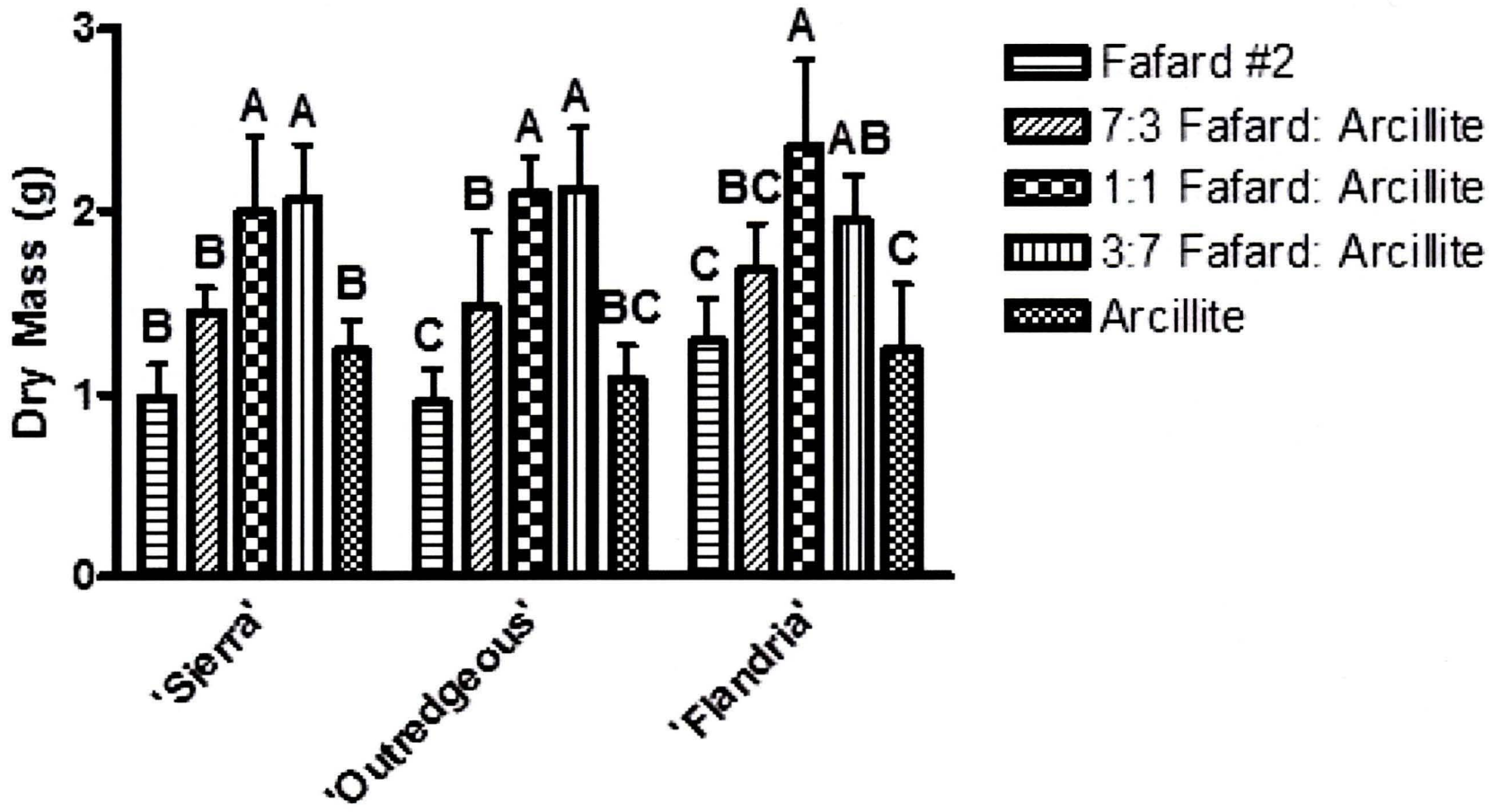
SPAD values


Chlorophyll Content (SPAD)
35
30
25
20
15
10
5
0
B
B
AB
AB
A
'Sierra'
'Outredgeous'
'Flandria'
Fafard #2
7:3 Fafard: Arcillite
1:1 Fafard: Arcillite
3:7 Fafard: Arcillite
Arcillite

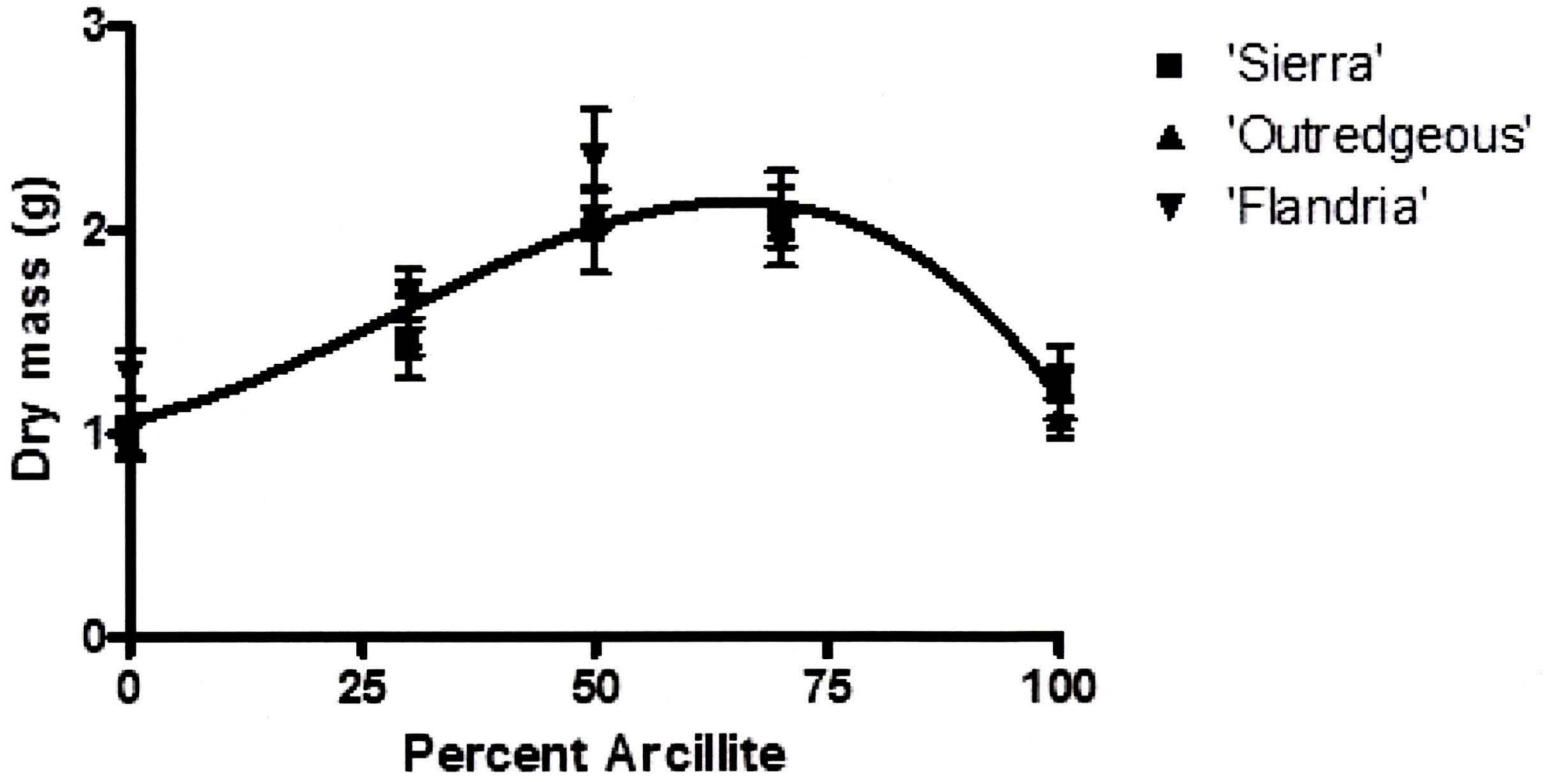
Leaf Area per plant



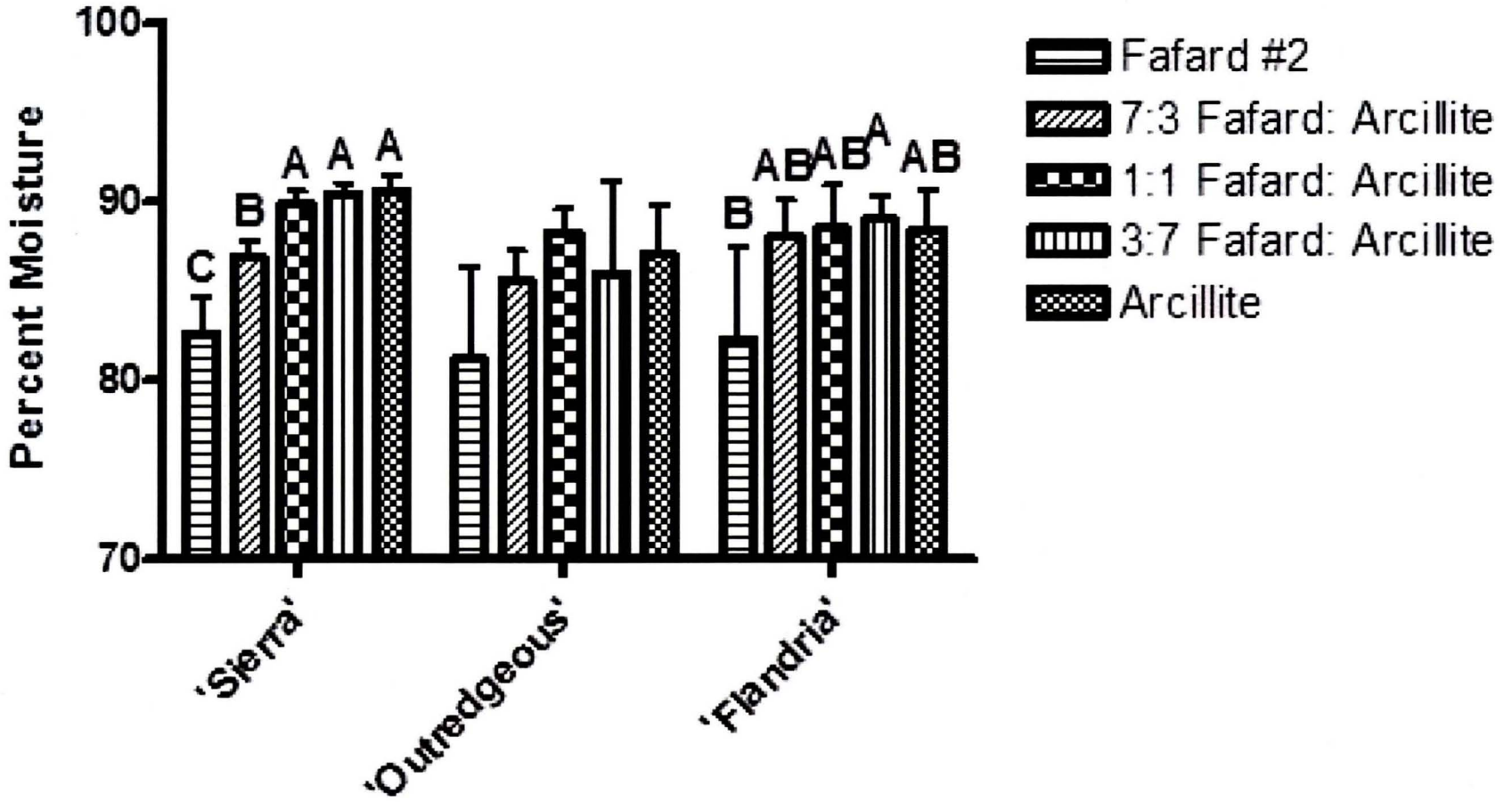
Lettuce Yield



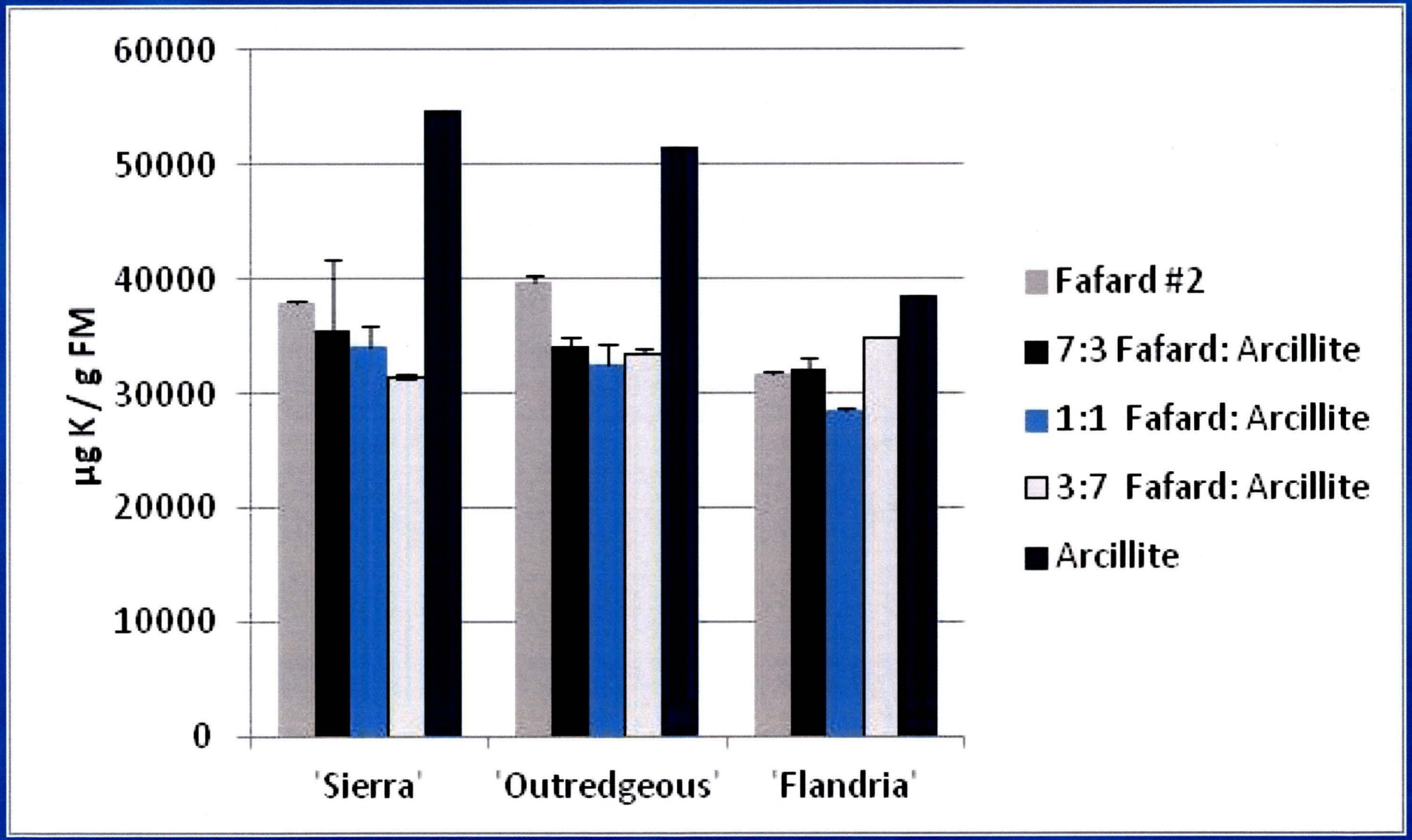
As a regression



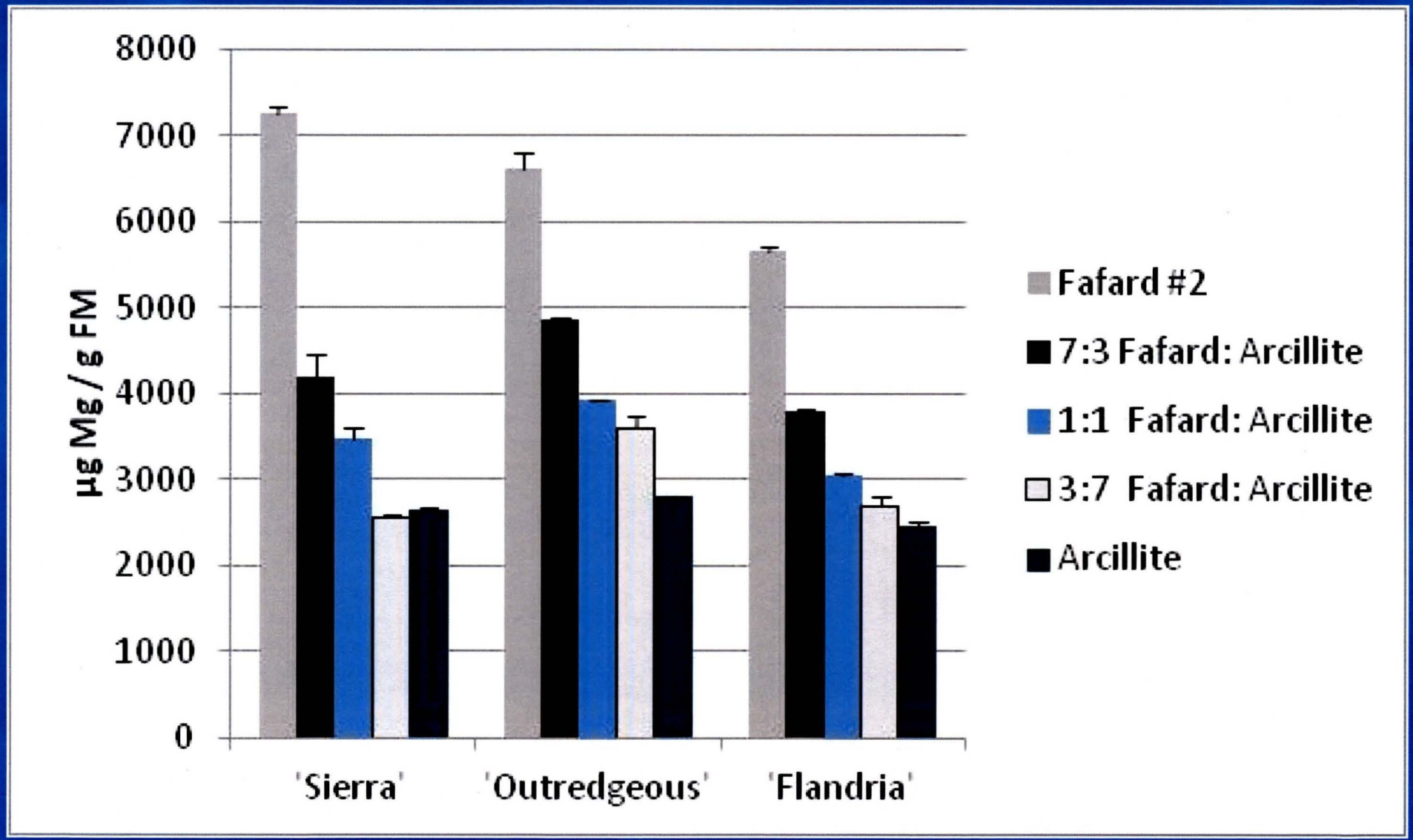
Tissue Percent Moisture



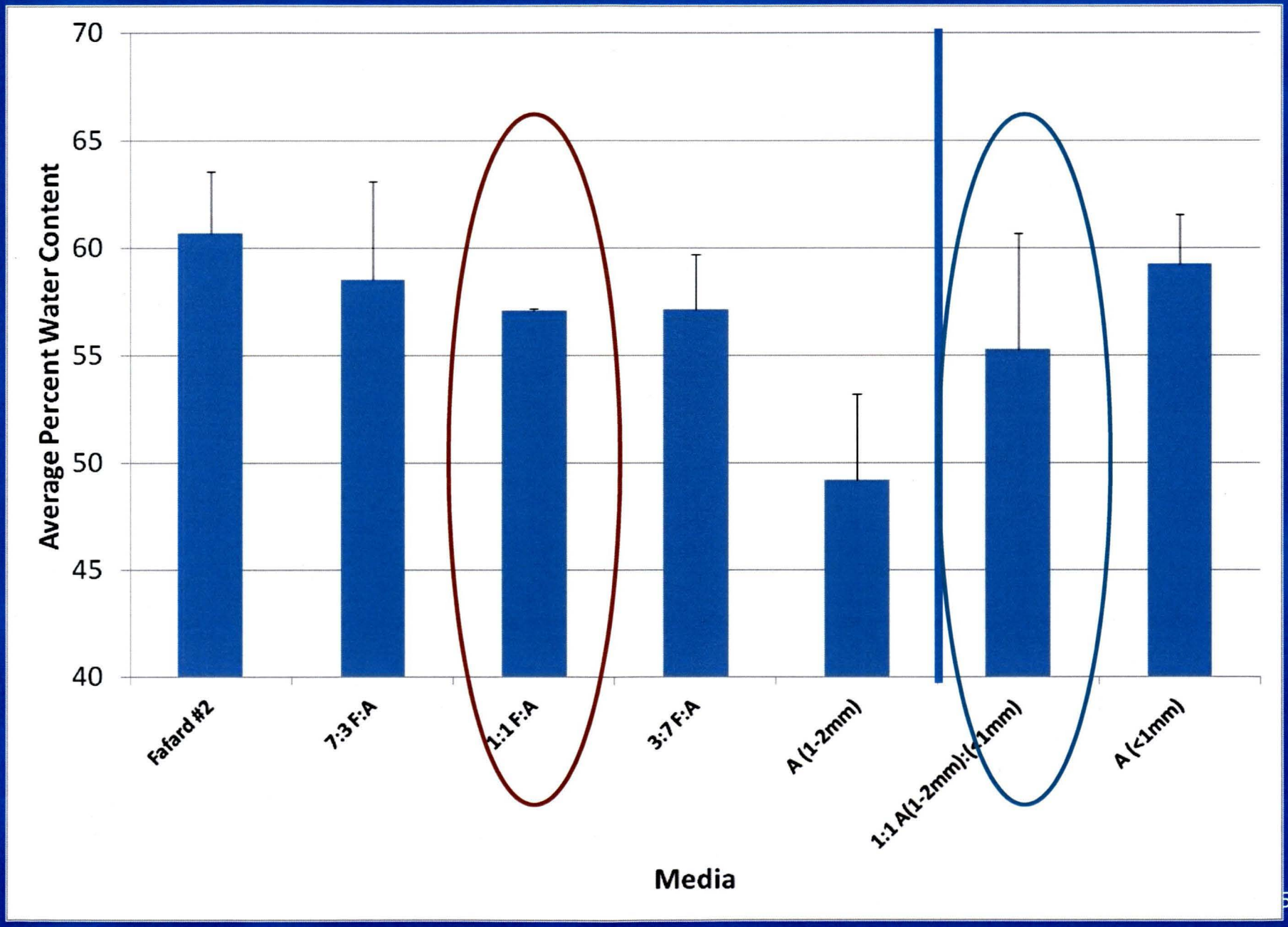
Tissue Potassium



Tissue Magnesium



Water content of media



Future Work

- Arcillite only – different particle sizes and combinations
- Microbial levels and food safety
- New species
  - Including ornamentals
- Testing with flight-design hardware
- Flight – Summer 2013

Thanks!

- Robert Morrow
- Janicce Caro
- Mary Hummerick
- Oscar Monje

- Anthony Nguyen
- Cedric Flemming

- Media consultants including Cary Mitchell, Bob Tripepi, and Profile Products, LLC
- Jack Fox
- Bryan Onate

Funding: NASA ISS-R