

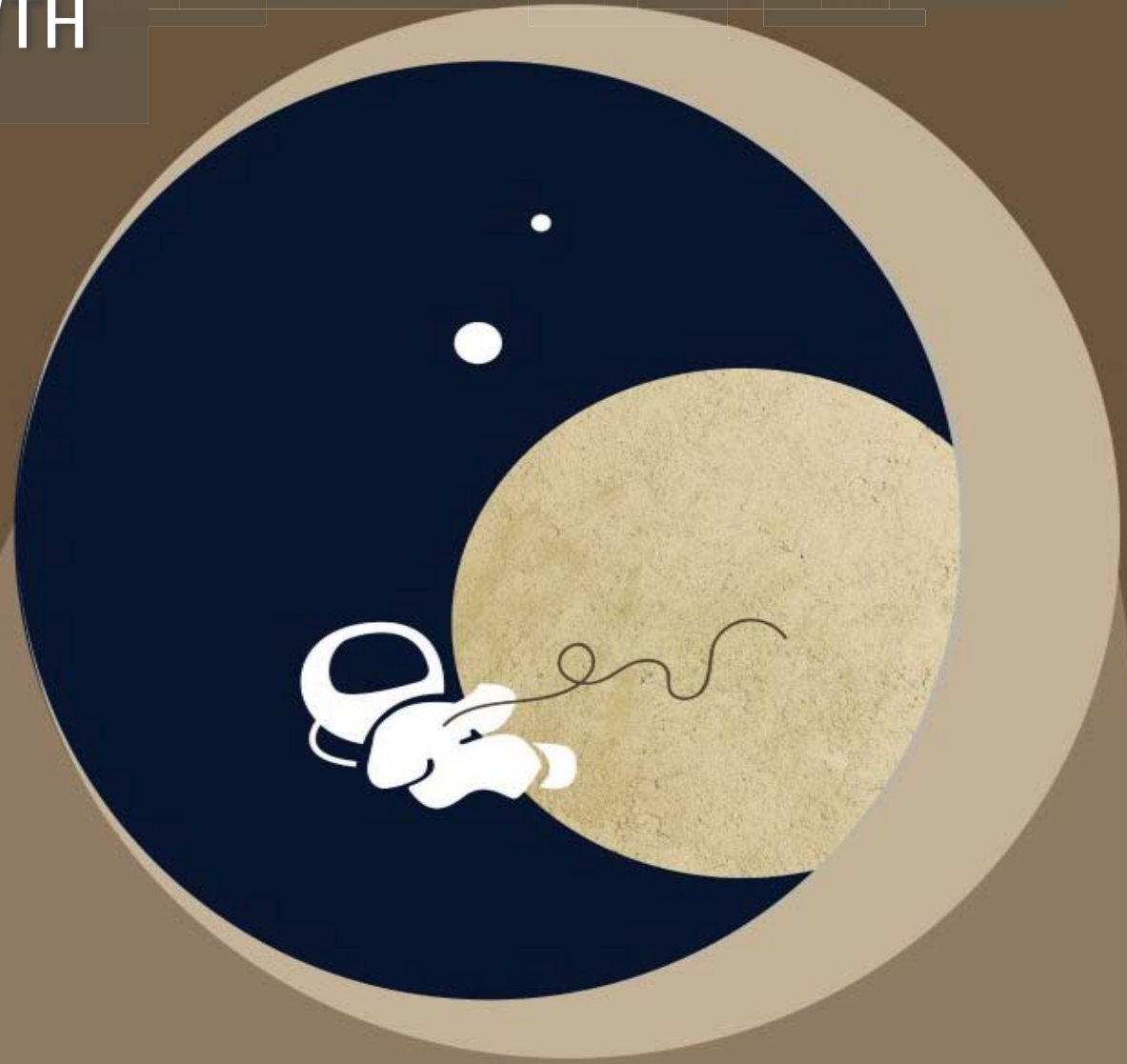
LIGHT QUALITY INFLUENCES DIFFERENTLY GREEN- AND RED-LEAF PLANT GROWTH

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CARMEN ARENA

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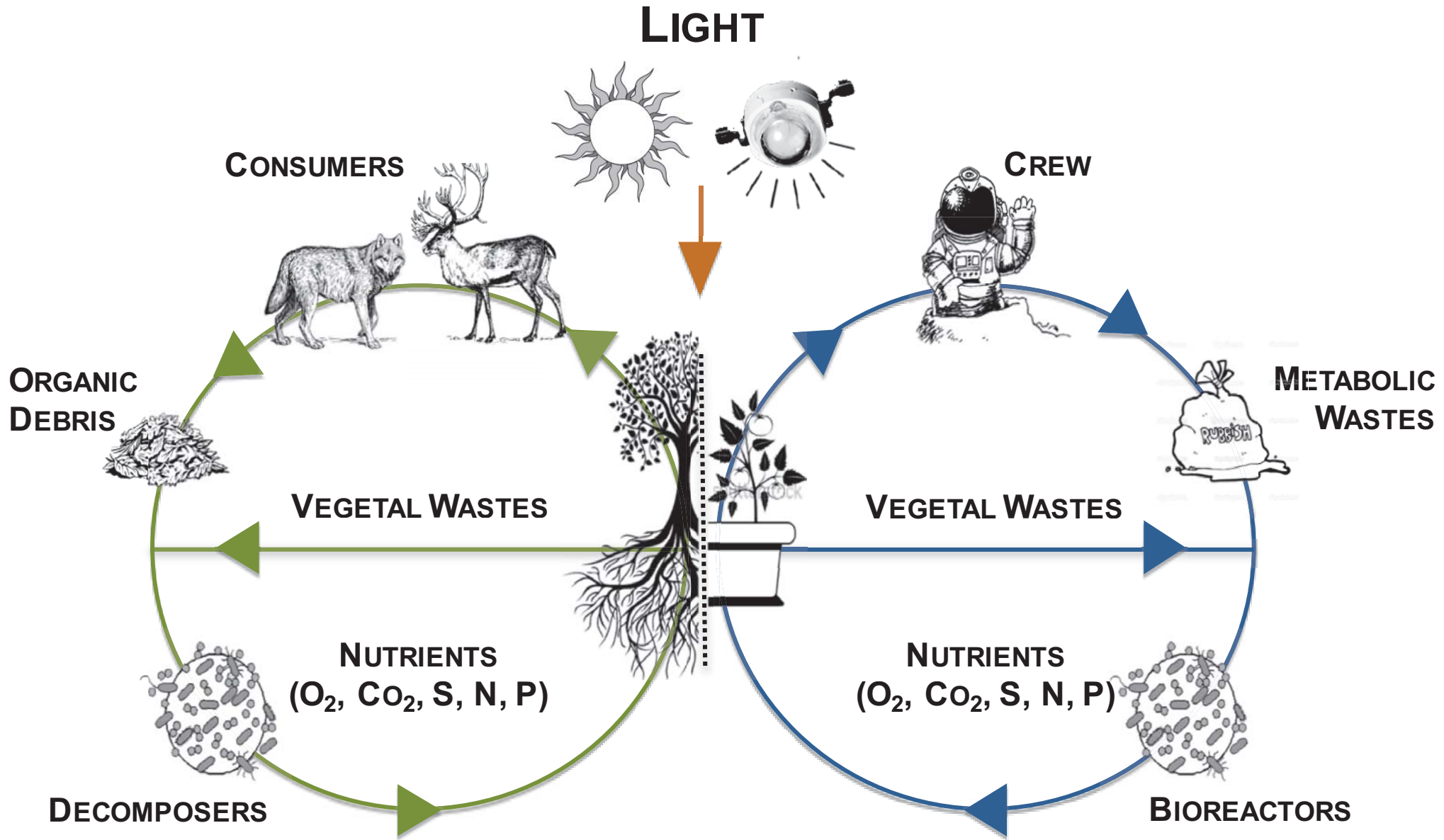
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ARTIFICIAL ECOSYSTEMS



ADVANTAGES OF LED LIGHTING

- High energy efficiency (low heat emission)
- Longest lifespan (50.000 – 100.000 hours)
- Ability to combine various wavelengths of light spectrum



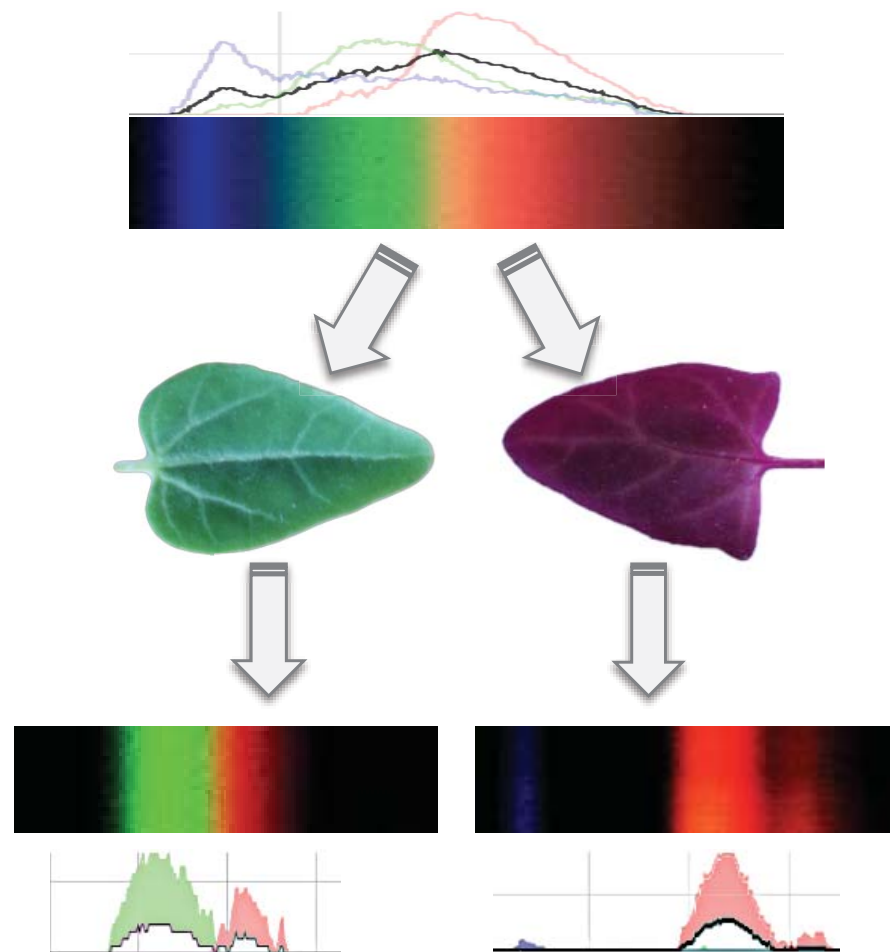
Spectral quality of LEDs significantly affects plant morphology and anatomy as well as the nutrient uptake (Massa et al., 2008; Arena et al., 2016).

LED technology provides advantages for a more efficient light utilization in controlled environments both on Earth and in Space (Darko et al., 2014).

Increasing efficiency of crop production with LEDs (Gómez & Izzo, *submitted*).

RED vs Green LEAF PLANTS

There is a growing interest in red-leaf plants because of the nutritional value of these crops and their beneficial impact on human health.

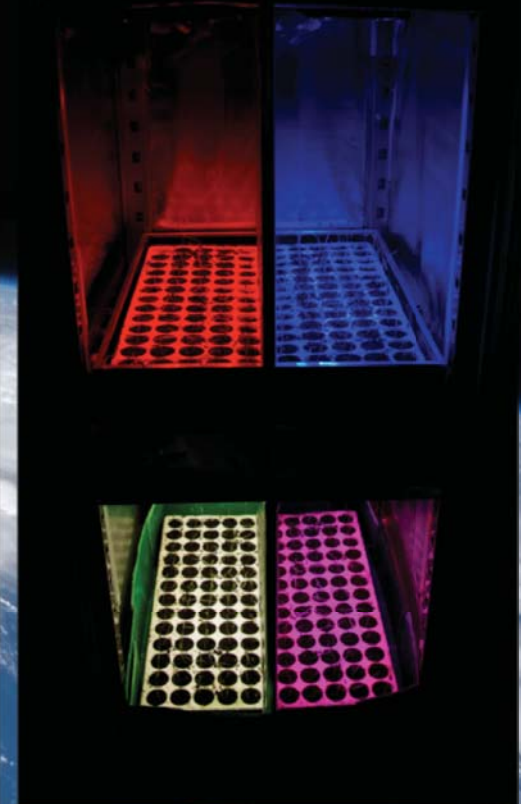


WHAT ARE THE LIGHT RECIPES THAT IMPROVE PRODUCTION, GAS EXCHANGES AND FOOD QUALITY OF RED AND GREEN LEAF CROPS?

OBJECTIVES

- Investigate how light may affect plant physiological performance in controlled environment.
- Improve plant growth and food quality in both red and green leaf plants by modulating light spectrum.

	nm
UV	370
UV	410
UV	420
B	450
B	460
C	500
G	530
Y	590
R	620
R	660
IR	730
IR	850
IR	940
W	5000-5500K
W	6000-6500K



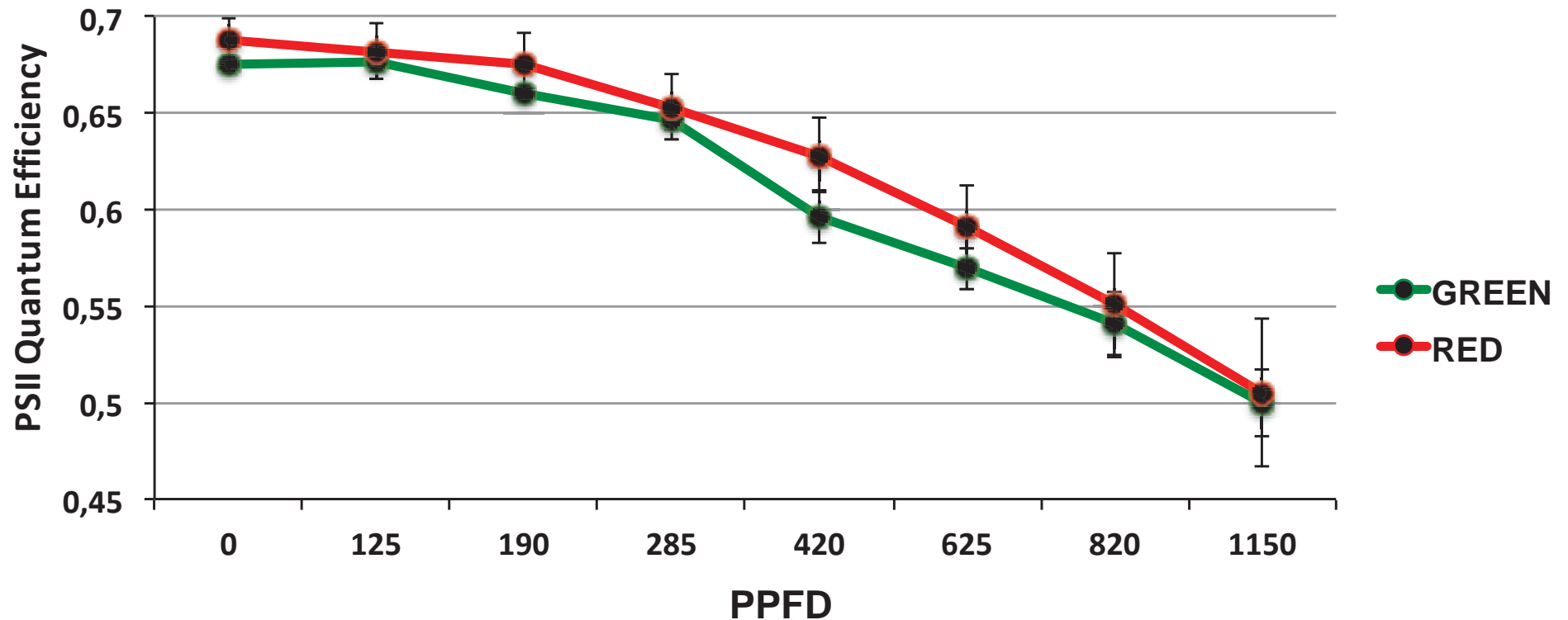
- **SPECIES**

Atriplex hortensis L. was selected as model species.



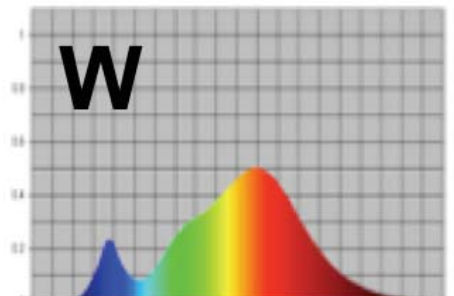
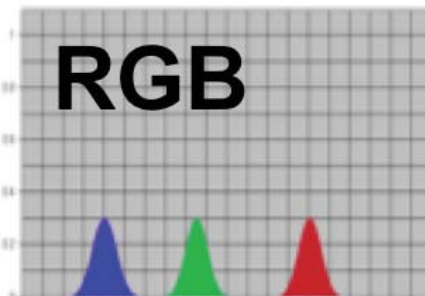
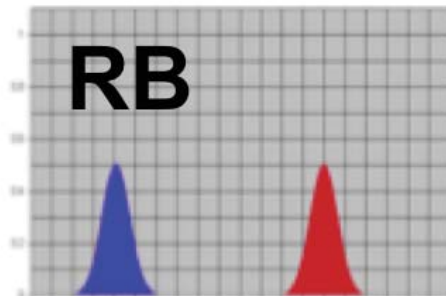
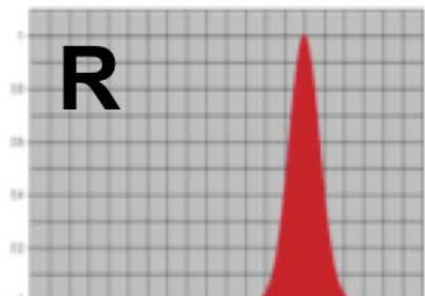
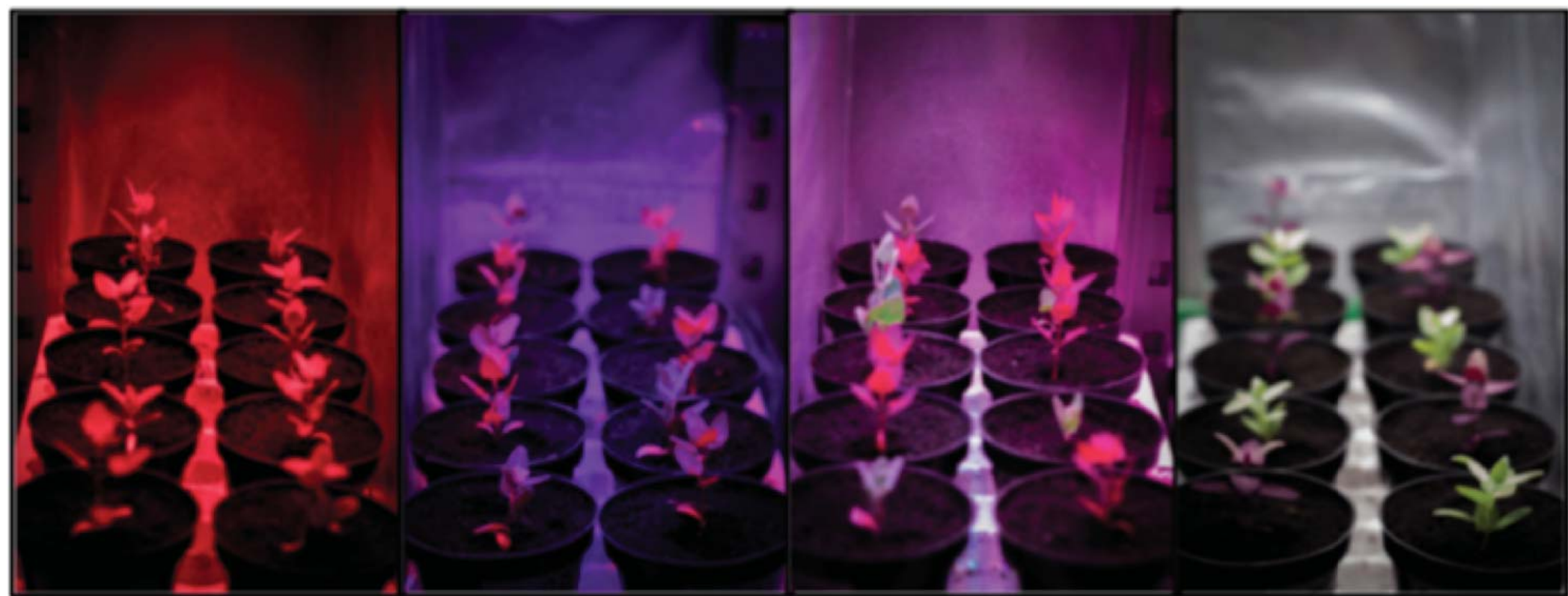
- **PRELIMINARY STUDIES**

Plants grown in sunlight



EXPERIMENTAL DESIGN

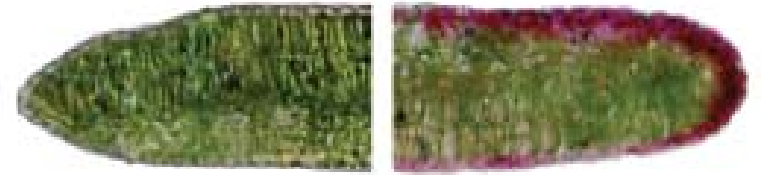
Red and green cultivars of *Atriplex hortensis* were grown under four light quality treatments (DLI: $11,52 \text{ mol}\cdot\text{m}^{-2}\cdot\text{d}^{-1}$)



INTEGRATED APPROACH: STRUCTURE AND FUNCTION

PLANT STRUCTURE

- ✓ Plant Morphology
- ✓ Functional leaf traits
- ✓ Leaf anatomy



PLANT FUNCTION

- ✓ Pigment composition
- ✓ Photochemical efficiency
- ✓ Gas Exchanges



REMARKS

The overall results showed different morpho-physiological strategies of acclimation to the different light qualities in the two cultivars.

RB and W turned out as the most suitable lighting conditions for both green and red cultivar of *Atriplex hortensis*.



WORK in Progress

W



RB



NEXT STEP

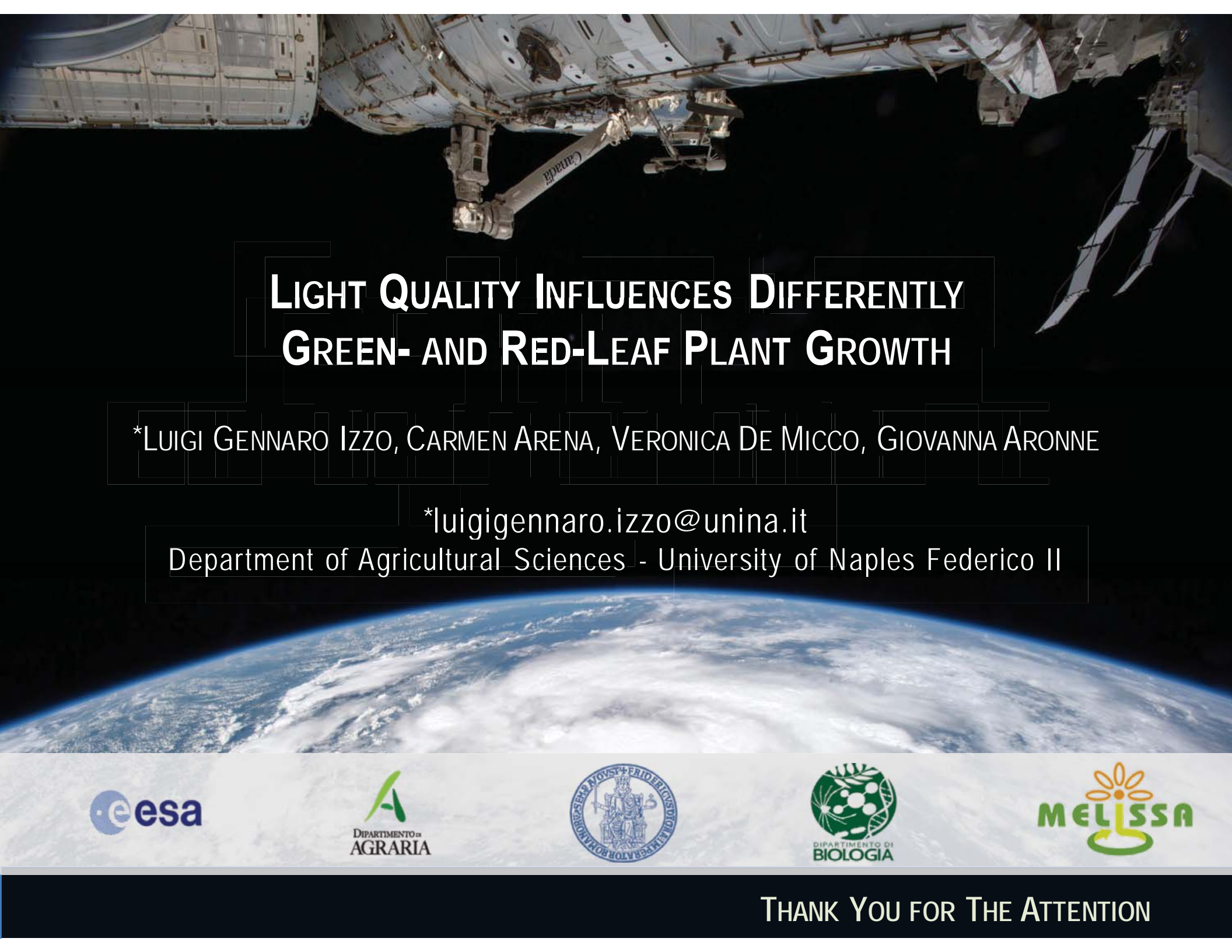
- **Gas Exchange Curves (A/I ; A/C_i)**
- **Determination of Maximal Photosynthetic Capacity (A_{max} , A_{sat})**
- **Expression of Key Proteins of Photosynthetic Apparatus (D1, LHCII, Rubisco)**



CONCLUSIONS

In the realization of lighting systems for plant-based BLSSs, light recipes need to be revised to optimize the production of red-leaf plants.





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THANK YOU FOR THE ATTENTION