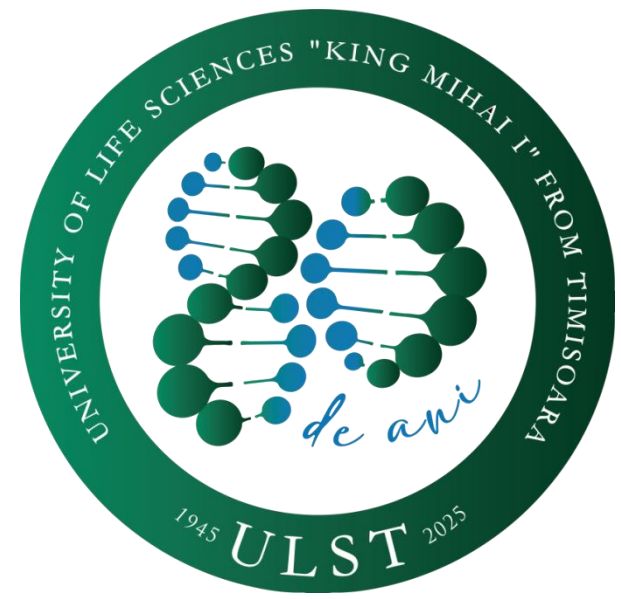




UNIVERSITY OF LIFE SCIENCES "KING MIHAI I" FROM
TIMISOARA
"YOUNG PEOPLE AND MULTIDISCIPLINARY RESEARCH
IN APPLIED LIFE SCIENCES"

13-14 November, 2025



"Young people and multidisciplinary
research in applied life sciences"

CHALLENGES AND PERSPECTIVES IN PLANT GROWTH UNDER MICROGRAVITY CONDITIONS

Aryan AHMADI¹, Ioan PET¹, Dorel DRONCA¹, Mirela AHMADI^{1*}

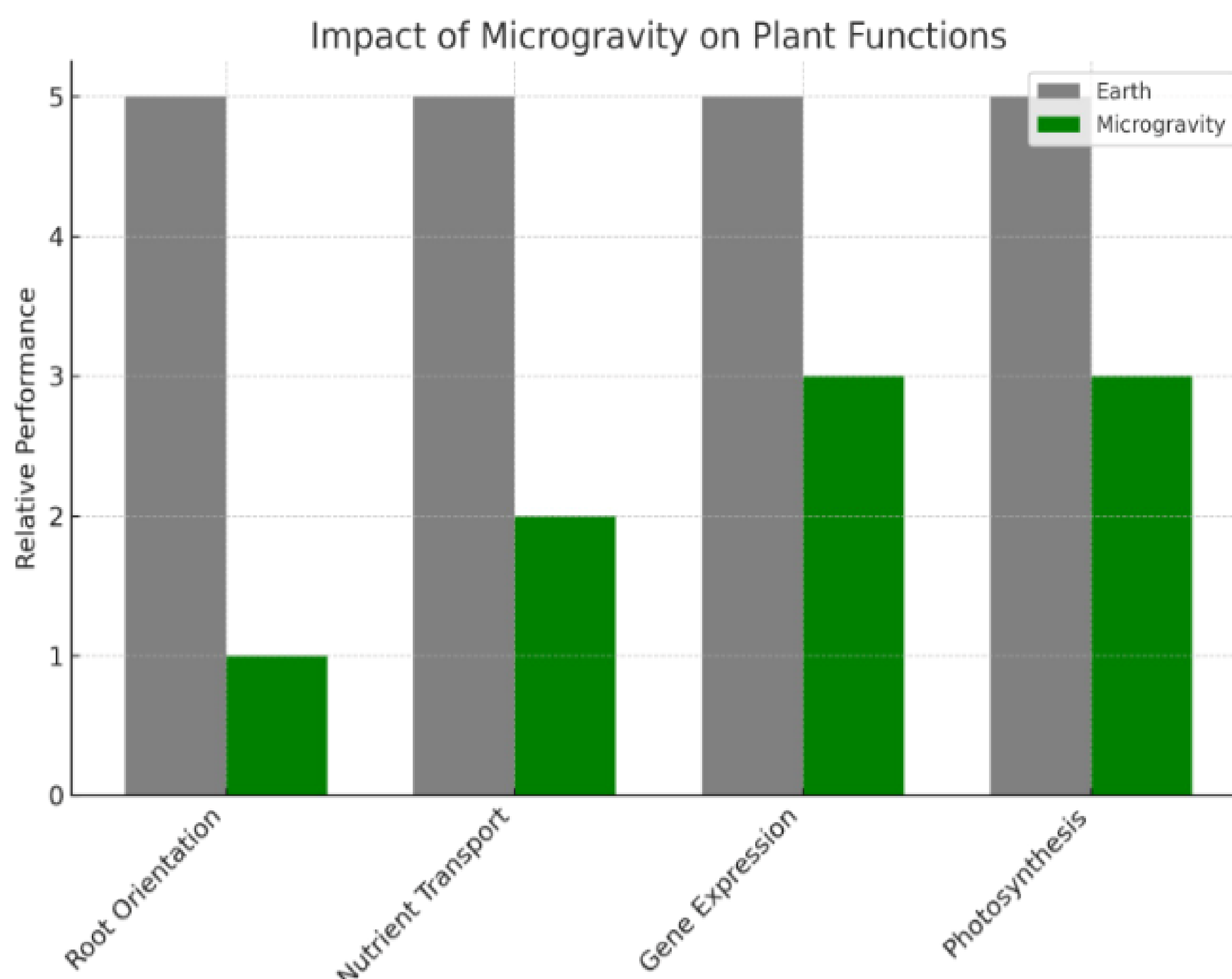
¹Faculty of Bioengineering of Animals Resources; Depr. Biotechnology

University of Life Sciences „King Mihai I” from Timisoara, Calea Aradului 119, Timisoara – 300645, Romania.

Abstract: Microgravity challenges plant growth by disrupting root orientation, water transport, and gene expression. This poster reviews current spaceflight experiments and explores biotechnological strategies – such as genetic engineering and synthetic biology – to enhance plant resilience. These advances are key to future space missions and sustainable agriculture on Earth.

• Importance of plants for space missions

- Oxygen production
- Food supply
- Water cycling
- Psychological benefits



• Main Challenges of Microgravity

❑ Microgravity Effects

- ✓ Random root orientation (loss of gravitropism)
- ✓ Disrupted water and nutrient transport
- ✓ Altered gas exchange (no convection)
- ✓ Changes in gene expression

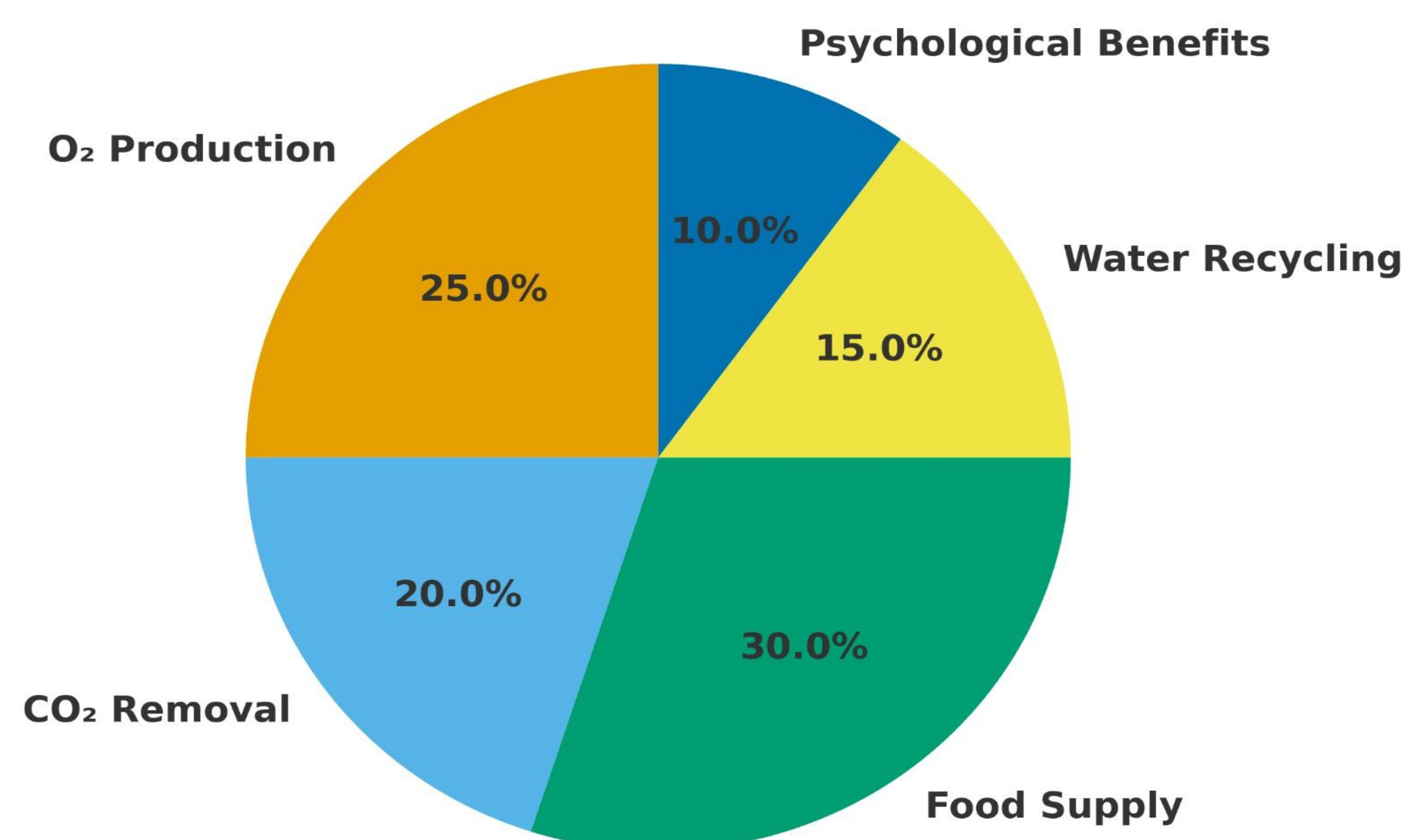
❑ Space Radiation

- ✓ DNA damage and mutation accumulation
- ✓ Oxidative stress via reactive oxygen species (ROS)

❑ Artificial Lighting and Atmosphere

- ✓ Photomorphogenesis under LED
- ✓ Low pressure, CO₂ variation
- ✓ Humidity and transpiration issues.

Plant Contributions in Closed-Loop Life Support



• Plant Responses to Stressors

- ✓ Reduced biomass, delayed flowering
- ✓ Altered root/shoot ratios
- ✓ Stomatal behavior changes
- ✓ ROS defense activation (e.g., SOD, catalase)
- ✓ Epigenetic and transcriptomic shifts

• Biotechnological Solutions

- ❑ Genetic Engineering / CRISPR: Radiation resistance genes (e.g., RAD51, UVR8); Modified auxin transport (PIN genes)
- ❑ Synthetic Biology: Synthetic gene circuits; Minimal plant systems
- ❑ Microbiome Engineering: Engineered rhizobacteria (e.g., Bacillus, Azospirillum); Synthetic microbial consortia for nutrient cycling
- ❑ AI and Smart Agriculture Systems: Automated hydroponics; Biosensors and feedback controls.

• Dual-use Benefits on Earth

Crops for deserts, urban farms, and climate resilience
Portable AI-driven farming systems for food security.