

**SENSORY ANALYSIS OF PLANTS
GROWN IN A CONTROLLED
ENVIRONMENT WITH
APPLICATIONS FOR FOOD
PRODUCTION ON-BOARD THE
INTERNATIONAL SPACE STATION
(ISS), HUMAN SPACE
EXPLORATION VEHICLES AND
PLANETARY OUTPOSTS.**



Dr Tracey Larkin

EDEN ISS PROJECT

HORIZON 2020 FUNDED PROJECT



**Gro
of
Plan
Tec
for
Pro
In S**

**AKA
greenhouse for ISS the
moon & Mars**



14 PROJECT PARTNERS



MAIN AIM OF THE PROJECT:

- A critical component of future, human exploration to worlds unknown, will be the supply of edible food for crew members. To develop innovations in cultivating food in closed-loop systems becomes integral to future missions.



EDEN ISS PROJECT AIMS

1. EDEN ISS will develop an advanced nutrient delivery system, a high performance LED lighting system, detection and decontamination procedures.
2. Develop food quality and safety procedures.
3. A mobile container-sized green facility will be built to demonstrate and validate different key technologies and procedures necessary for safe food production within a closed system.

CELLS plant
growth &
biochemical
analysis.

Food@LIT
sensory analysis.

Antarctica



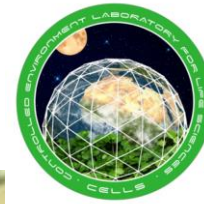
CLOSED LOOP SYSTEMS

1. Optimum nutrients (Hoglands solution)
2. Optimum LED lighting
3. Optimum CO₂.

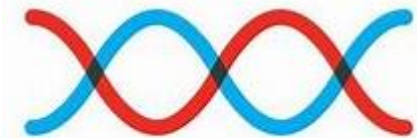


CELLS Research Group:

- Exploits and develops frontier technologies for the manipulation of plant growth using controlled environmental conditions
- NASA alliance and training



CELLS
RESEARCH
GROUP



Shannon ABC

Shannon Applied Biotech Center

Biochemical analysis





Dr Tracey Larkin, Killaloe; Dr Peter Downey and Ms Michelle Mc Keon Bennett, Bunratty pictured in an environmental growth chamber, while working on of the Eden -ISS project. Photograph by John Kelly

FOOD@LIT SENSORY ANALYSIS

1. Determine overall acceptability (palatability) for each crop harvested by CELLS.
2. Further analyse each crop via descriptive analysis for appearance, flavour, texture and aftertaste to generate quantitative data which describes the similarities or differences for each harvest versus a shop bought control.
3. Provide for each harvest a sensory (palatability) result – acceptable/unacceptable.



SENSORY METHOD

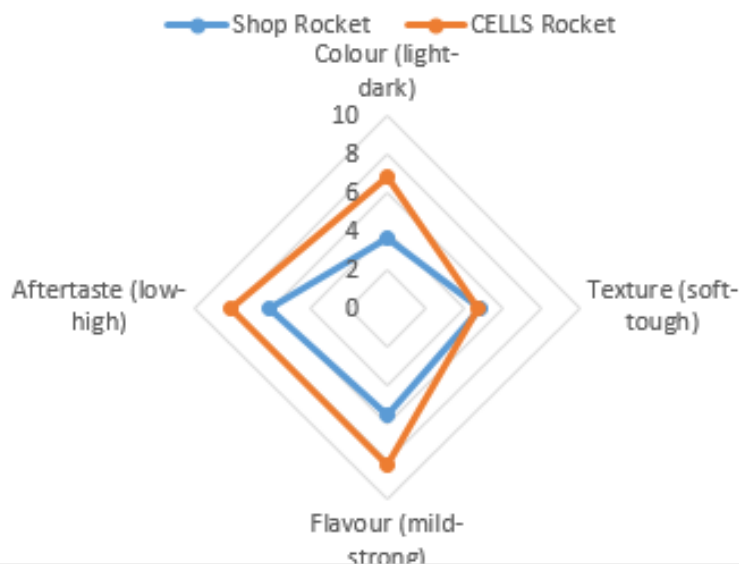
Sample 234

Please write comments |

- 9 ☐ I like it extremely
 8 ☐ I like it very much
 7 ☐ I like it moderately
 6 ☐ I like it slightly
 5 ☐ I neither like or dislike
 4 ☐ I dislike slightly
 3 ☐ I dislike moderately
 2 ☐ I dislike it very much
 1 ☐ I dislike it extremely

/ CELLS
do not
sample.

Rocket day 28 (CeRoc2 28)



or descriptors.
each descriptor to
1.

SENSORY RESULTS

	Harvest	Acceptability	Crispness (crisp)	Texture (soft-tough)	Flavour (bland-flavoursome)	Aftertaste (low-high)
Sample						
CE					2.5	
Ro					2.3	
CE					3.2	
Ro						

SENSORY SAMPLES



SENSORY DATA ANALYSIS & GOALS

1. Compare acceptability and descriptive results for significant differences.
2. The acceptability score is very important as this will drive out if the significant differences are acceptable or not for the CELLS samples i.e. are the samples palatable.
3. Ultimately the goal for the sensory analysis is to guide harvest times and determine if the CELLS samples are palatable.



SENSORY CONCLUSIONS

CELLS code	Sample	Acceptable/ unacceptable	Descriptive analysis
CEL2 35	Red Romaine day 35	Acceptable	Same as shop control.
CEL1 56	Red Romaine day 56	Acceptable	CELLS Red romaine at day 56 has a tougher texture
CEL3 28	Red Romaine day 28	Acceptable	Same as shop control.
EDLred1 28	Red romaine day 35	Acceptable	Same as shop control.
CERoc1 35	Rocket day 35	Acceptable	CELLS rocket is greener
CeRoc2 28	Rocket day 28	Acceptable	CELLS rocket is greener with stronger flavour and aftertaste.
EDRoc1 28	Rocket day 28	Acceptable	CELLS rocket greener, stronger flavour and aftertaste
CERh1 35	Radish day 35	Acceptable	CELLS radish is less crisp with a significant aftertaste.
CERh2 28	Radish day 28 Purple plum	Acceptable	CELLS Purple plum has stronger flavour & after taste.
CERan1 28	Radish day 28 Anabel	Acceptable	CELLS Anabel has stronger flavour & after taste.
EDRrax1 28	Radish day 28 <u>Raxe</u>	Acceptable	Same as shop control.
EDRlen1 28	Radish day 28 Lennox	Acceptable	CELLS Lennox has a stronger flavour.
CESp1 28	Spinach day 28	Acceptable	Cells spinach is darker green with a tougher texture, stronger flavour and aftertaste.
EDSred1 42	Spinach day 42 Red kitten	Acceptable	CELLS spinach is darker with a stronger flavour & aftertaste.

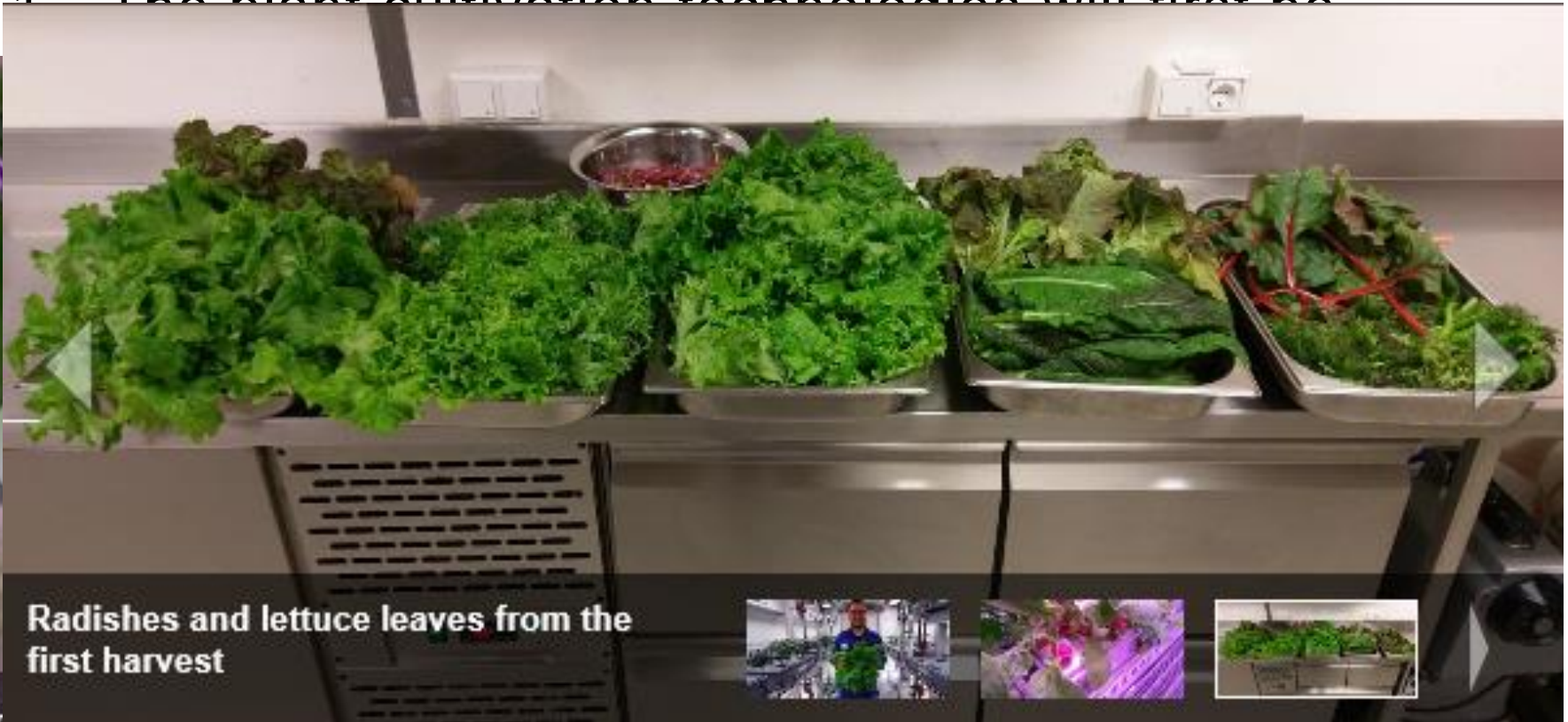
EDRM1 28	Red mustard day 28	Acceptable	CELLS red mustard is green (rather than purple) with a stronger flavour and aftertaste.
EDLexp1 42	Lettuce day 42 Crisp green	Acceptable	Same as shop control.
EDLbat1 42	Lettuce day 42 Bativa	Acceptable	Same as shop control.
EDSC1 42	Swiss chard 42	Acceptable	CELLS Swiss chard is darker with a stronger flavour & aftertaste (when compared to spinach).
3469	Tomato	Acceptable	CELLS tomato softer with a lighter skin texture.
F11202	Tomato	Acceptable	CELLS tomato softer with a lighter skin texture.
Quatro	Cucumber	Acceptable	CELLS cucumber is juicier.
Picowell	Cucumber	Acceptable	CELLS cucumber is juicier.

CONCLUSIONS

- Some of these differences measured maybe due to a difference in cultivar between the CELLS and the shop bought controls. However in general the CELLS samples due to the closed optimum protected system produced plants with enhanced colour and flavour. In terms of texture this can be increased e.g. spinach or decreased e.g. tomatoes.
- Regardless of the specific sensory descriptor differences all of the CELLS grown plants are acceptable and palatable. In general the significant differences between the CELLS and the shop bought controls are favourable and may in some cases produce an enhanced product once harvested at an earlier rather than late harvest date.

ANTARCTICA AIMS

1. The plant cultivation technologies will first be



Radishes and lettuce leaves from the first harvest

Radishes before harvest



of the EDEN ISS project will provide year-round fresh food supplementation for the Neumayer Station III crew.

ANTARCTICA SENSORY ANALYSIS



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ANTARCTICA SENSORY GOALS

1. To determine the palatability of the samples when growth on the Antarctica station by the crew using the optimum technologies developed.
2. The sensory analysis will begin this month and the sensory sheets will be returned for data analysis.



CREW FIRST TESTED TOMORROW!



FOR MORE INFORMATION

- <http://eden-iss.net/>





EDEN ISS shared Alfred-Wegener-Institut für Polar- und Meeresforschung's post.

April 15 at 9:09pm · 🌐

#marchforscience #madeinantarctica



Alfred-Wegener-Institut für Polar- und Meeresforschung

April 14 at 11:09am · 🌐

👍 Like Page

"knowledge and recognition are the joy and legitimacy of mankind" - our rentals at the station iii send to all participants of the #March for science support gr...



THANK YOU
&
QUESTIONS?

