NASA Food Technology Commercial Space Center

Symbioses in Space I: Plants and Microgravity by Heidi Kratsch

---

BACKGROUND

Plant foods constitute most of an astronaut's diet during space travel. A three-month's supply of food is stowed inside the shuttle for short trips, but food crops will need to be grown in space for the large amounts of food needed for long trips to the moon and to Mars. Plants grown in space have the same requirements as plants grown on Earth; they need light, water, nutrients, and CO_2. Constraints that will need to be considered for cultivation of food crops in space include: air, water, waste, light, space, and gravity.

Questions to think about:

- How will plants respond to the microgravity environment of space?
- What kinds of beneficial interactions might occur between plants and humans in space?

LESSON SUMMARY

This activity is appropriate for college-level students with a background in biology, botany, and/or plant physiology. It can be used in conjunction with Symbioses in Space II: Soybeans in Space, which is designed as a laboratory exercise for this lesson.

STUDENT LEARNING OUTCOMES

The student will…

1. Predict the effect of microgravity on plant physiological processes. (Content)
2. Develop criteria for testing selected plant cultivation systems for use in space. (Content)
3. Practice active listening skills in face-to-face interactions. (Communication)
4. Summarize and provide justification for his/her ideas. (Communication)

ASSESSMENT/ EVALUATION

Evidence of student learning includes:

1. Identification of at least one way in which a plant will be affected by growth in a microgravity environment.
2. Communication of at least three criteria for use in judging plant cultivation systems for use in space.
3. Appropriate verbal and nonverbal responses to his/her learning partner.
4. Volunteering at least one idea and one response to the idea of another in

group and class discussions.

RATIONALE FROM KNOWLEDGE ABOUT LEARNING

1. Introducing students to new terminology and concepts provides them with a context for learning and exposes them to terms that may be confusing and therefore may interfere with their ability to participate fully in the activity.
2. TTYP is a great activity for giving students practice in interactive skills and can be used to focus the attention of the class. Asking students to think about and share their ideas about how plants respond to microgravity exposes them to new ideas and helps them transfer previous learning to novel situations.
3. Most people can focus their attention for about 8 to10 minutes without a break. Short "mini-lectures" provide needed background information without losing the attention of the class.
4. Collaborative teamwork promotes deeper learning of complex or abstract information and helps students develop decision-making and communication skills.
5. Working together as a class to develop an assessment tool allows students the opportunity to process and apply what they've learned and develops student ownership and accountability for their work.

MATERIALS

Pens/pencils (one per student)
Transparency sheets and water-soluble markers (one set per group)
"That NASA Show:Tortillas in Space" space farming segment. NASA vhs (optional)

INSTRUCTIONS GIVEN TO STUDENTS

1. Instructor provides a mini-lecture on Space and Microgravity http://www.grc.nasa.gov/WWW/PAO/html/microgex.htm. For more information, visit http://science.nasa.gov/headlines/y2003/25feb_nosoap.htm.
2. Turn To Your Partner (TTYP): In pairs, students predict how growth of a plant in the microgravity environment of space will affect basic physiological processes (e.g., translocation of water, orientation of roots and shoots in space, uptake of nutrients, cellular growth, photoperiodic responses such as flowering).
3. Divide processes between groups for variation in discussion. Reconvene as a class to share ideas.
4. Instructor provides a mini-lecture on growing plants in space http://www.usu.edu.cpl/ or http://advlifesupport.jsc.nasa.gov/ALS-sites.html) or have students view "That NASA Show" video segment on space farming.
5. Students work in teams of three to four to create an assessment tool to be used for evaluating cultivation systems for growing plants in space. Reconvene as a class to synthesize a single assessment tool. Each team will designate a spokesperson, who will present their tool to the class

and provide justification for its use. After the student presentations, the class will come to consensus on which criteria will be used. This tool may be used in the lesson, Symbioses in Space II: Soybeans in Space.

Instructor:
Heidi A. Kratsch
Department of Horticulture
Iowa State University
hkratsch@iastate.edu

LEGEND:

—COMMUNICATION MATERIALS
—PROJECT LEARN MATERIALS
—INSTRUCTOR MATERIALS