FALL '25 CHALLENGE
GROW MORE WITH LESS
STEM CHALLENGE
GEORGIA AG EXPERIENCE
A MOBILE CLASSROOM POWERED BY
GEORGIA FOUNDATION FOR AGRICULTURE

IMPORTANT DATES

- Registration Period closes on: September 15, 2025 by 5 PM
- All projects must be submitted online by: November 21, 2025 by 5 PM
- Winners will be announced over zoom on: December 5, 2025 @ 1 PM

Project Title: **Grow More with Less: Engineering a Soil-Free Future**	**Grade Level: 3-5**

Driving Question: How can we design a system to grow food without soil using only water, nutrients, and recycled materials in limited space?

Guiding Standards

Georgia Standards of Excellence:

- S3L2.a: Explain the effects of pollution (such as littering) on the habitats of plants and animals.
- S3L2.b: Identify ways to protect the environment, such as conservation and recycling.
- S5P2.a: Plan and carry out investigations of physical changes by manipulating, separating, and mixing materials.
- SEV4: Obtain, evaluate, and communicate information to analyze human impact on natural resources.

AFNR (Agriculture, Food, and Natural Resources) Standards:

- 3AS1: Recognize how agriculture impacts daily life through food, clothing, and shelter.
- 4AS2: Explore the connections between natural resources and agriculture.
- 4FA3: Identify how agricultural practices influence the environment.

Guiding Background Knowledge:

What is hydroponics?

- Hydroponics is a method of growing plants without soil, using nutrient-rich water solutions. It involves suspending plant roots in a water-based solution or an inert medium like perlite or vermiculite, while delivering essential nutrients.

Why is hydroponics Important?

- Creates farming opportunities in urban spaces.

- It offers an efficient and sustainable way to grow plants.
- Conserves water and other natural resources.
- Reduces pollution by reducing the use of chemicals.
- Creates jobs: Boosts economic benefits by supporting NASA space station agricultural careers and urban agricultural careers.

Challenge Ideas:

Urban areas have limited space for crop growth, obstacles can affect plant growth, harvests, and overall efficiency in farming. Using hydroponics can increase crop production and help address the challenge of growing in limited spaces.

- Design a soil-free system to grow a leafy vegetable (like lettuce) using only water, nutrients, and recycled or lightweight materials. Your design must:
- Use no soil
- Be compact and small enough to fit in a space station or other type of limited space.
- Conserve water
- Allow roots to stay moist and receive nutrients

Examples of Recyclable Materials:

- Clear plastic cups, bottles, jugs, or glass containers.
- Sponges, cotton balls, felt, or other water absorbent materials for project.
- String, wire, pipe cleaners
- Water
- Nutrient solution (or dissolved plant food)
- Seeds (lettuce, basil, etc.)
- Recycled containers

STEM Tie-Ins

- Engineering: designing and building the system
- Science: understanding plant needs and nutrient cycles
- Math: measuring water levels, tracking plant growth over time

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Video Suggestions:	**Book Suggestions:**	**Ask a Community Expert:**
1. NASA- Growing Peppers in Space 2. Build Your Own Hydroponics 3. STEM for KIDS	1. *Ellie in Space* by Eliana Sherriff 2. *Hydroponic Hijinks*, by Rie Neal, Talitha Shipman 3. *All About Hydroponics*, by DeWaynne Hotchkins	1. 4-H Agent 2. Local Farm Bureau Office 3. Ask NASA about their hydroponics program - Submit a question through the NASA website: NASA has a general "Submit a Question" form where students can submit inquiries related to various topics, including potentially hydroponics. Questions usually take 10 to 15 days for a response 4. UGA extension cooperation 5. Local hydroponic farmers and growers in the state of Georgia
Agricultural Career Connections: Careers 1. Agricultural Mechanic 2. Agricultural Engineer 3. Agricultural Biologist 4. Horticulture		**Vocabulary Words:** 1. Hydroponics 2. Seedlings 3. Conservation 4. Recycle 5. Space Station 6. Sustainability

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Lesson Procedures:

Engage: Start with a Question:

- **Show a picture of a hydroponic system. Ask:**
  What is this? Why would we ever need to grow plants out of soil?
- **Reveal the challenge**: Imagine you live in the city in an urban area with limited space. You're going to become inventors! Your mission is to create a hydroponic system, plant, and grow vegetables and herbs using no soil!

Quick Brainstorm

- Write a few example problems on the board (e.g., congested areas in big cities, areas where healthy soil is limited, or a space station).
- Ask students to shout out quick ideas about materials they would like to use to design their project and what they would like to plant.

Kick Off with a Question:

- **Begin with:** What problems do you see in growing plants with no soil? What are the benefits of Hydroponics? What are obstacles in hydroponics?
- **Pose the challenge:** How would you design this? How would it work? How could I overcome any potential obstacles?

Real-World Inspiration:

- Share a short video like the NASA video to introduce hydroponics and its potential to solve challenges.
- Highlight real-life examples of farmers in your community or state using hydroponics.:
  - Are there local hydroponics in your community? State?
  - Why do you think they designed a hydroponic system?
  - What resources do we need?.

Brainstorm Ideas

- As a class, brainstorm ideas and list them on the board.
- Decide together how the class will select, design, build, and implement the project, and distribute responsibilities.
- Answer the following questions: What will our design be? What materials do we need? How will it work? What is the predicted outcome?

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Explore: Investigate and Research

1. **Research Agricultural Problems**
    - Divide students into groups. Have them discuss the need for hydroponics and what they would do if faced with limited space and needed to grow their own food.
    - Groups should research using books, videos, and online resources.
2. **Explore Hydroponics:**
    - Students will select materials that have been used to build hydroponic systems such as water bottles, bottles, glass containers, PVC pipes, pipe cleaners, string, and other materials needed to complete the project.
    - Encourage groups to think creatively about how these materials can be used to create their system.
3. **Learn from Experts**
    - Invite a guest speaker, such as 4H, to discuss agricultural challenges.
    - If a speaker isn't available, encourage students to find videos or articles to learn more about these topics.
4. **Plan the Solution**
    - As a group, create initial sketches of their designs, labeling materials and explaining how the project will work.

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Test

1. **Build a small demo of your hydroponics system.**
    - A small area of pipe or a small water bottle.
    - Make sure your design can effectively hold water and sustain materials..
    - Make sure the materials and resources you collect can effectively sustain plant growth.
2. **Guide the Testing Process**
    - As a group, design your hydroponic system.
    - Talk about the design before starting the test.
    - Observe and take notes as groups test their prototypes. Encourage them to document their findings:
        - What worked as planned?
        - What didn't work as expected?
        - What was surprising?
3. **Facilitate Group Discussions**
    - Once the project is designed, discuss the project, bring them back together to discuss results. Use guiding questions like:
        - What did you learn from the test?
        - What parts of the design need improvement?

Improve

1. **Help Groups Analyze Results**
    - Provide time for groups to review their test results.
    - Encourage students to think about practical changes they can make to improve their designs.
2. **Guide the Redesign Process**
    - Supply or find additional materials if needed.
    - Give groups time to make adjustments to the prototypes based on their analysis.
3. **Facilitate Retesting**
    - Have groups retest their improved models. .
    - Ask them to observe and document whether their changes made a difference.
4. **Plant and Track Plant Growth**
    - Plant your selection.
    - Track your plant growth
    - Determine what is working and what is not.
    - Make adjustments to support plant growth.
    - Document your findings.

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5. **Wrap Up with Reflection**
    - After testing and improving, lead a class reflection:
        - How did your design solve the problem?
        - How could it help in real life?
    - Encourage groups to write or present a summary of their process, including what they learned, what are the benefits, and what were obstacles they faced along the way.

Student Presentation:

Consider answering these questions during your submission video.

- Why is hydroponics important?
- How does your design address the problem?
- What steps did you take to create and test your projects?
- What changes or improvements did you make after testing your design?
- How could your solution help farmers or the environment in urban areas or in limited space?

Rules:

- The video should be no longer than **five minutes**
- There will be **one video submission per class**
- Upload the final class presentation to the STEM Challenge portal for judging by **November 21, 2025.**
- **Submission Form Linked here.**

If you are having trouble connecting to a community partner, please email your local Farm Bureau or info@georgiaagexperience.org

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Suggested Challenge Timeline:

Week 1: Kickoff & Brainstorming

- Discuss "Farming in Limited Spaces".
- Show a short video (NASA, ISS footage) of astronauts growing peppers in space.
- Class discussion: What challenges might you face trying to grow plants in urban areas or in limited spaces with no soil available?
- Brainstorm why soil isn't always available for farming.
- Determine what type of hydroponic you will design.

Week 2 and 3: Research & Planning

- Design a Hydroponic System
- Challenge Prompt: Gather materials and plan accordingly.
- Design a soil-free system to grow a leafy vegetable (like lettuce) using only water, nutrients, and recycled or lightweight materials. Your design must:
  - Use no soil
  - Be compact enough to fit in a small indoor space
  - Conserve water
  - Allow roots to stay moist and receive nutrients

- Suggested Materials:

  - Clear plastic cups, PVC pipes, or bottles
  - Sponges, cotton balls, or felt
  - String, wire, pipe cleaners
  - Water
  - Nutrient solution (or dissolved plant food)
  - Seeds (lettuce, basil, etc.)
  - Recycled containers

Week 4: Build Project

- Groups begin building their designs using selected materials.
- Encourage creativity while ensuring the prototypes align with their chosen problem and solution.
- Support the group by asking guiding questions and helping them troubleshoot challenges.

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Week 4: Testing

- Test your hydroponic to ensure it holds water, and fits into your indoor allocated space.
- The group will test their design and document their results, and identify what worked and what needs improvement.
- Facilitate a class discussion to share testing experiences and learn from each other.

Week 5: Improve & Retest

- Groups analyze their test results and identify practical ways to improve their hydroponics..
- Discuss additional materials as needed for redesigns.
- Retest the improved projects and document new results.
- Begin preparing materials for planting and begin reviewing the documentation process of plant growth.

Week 6:

- Finalize what type of vegetable/herb you will plant.
- Add materials (water, nutrients, seeds, and other determined materials.
- Plant your seedling/plants in your hydroponic system.

Week 7 and 8: Observe plant germination/growth over time.

- Record daily measurements, water levels, and changes.
- Reflect on what is working and what needs improvement.
- Modify systems as needed and explain why.

Week 9: Review

Each group will discuss the hydroponic system and plan the online presentation.

- Share data, design process, results, and any obstacles they faced.
- Compare Earth-based farming to space farming.
- Students finalize their research and development notes.

Week 10: Final Presentation

- Create a short presentation or video.
- Each group presents their hydroponic system.
- Share data, design process, and what they would do differently next time.
- Compare Earth-based farming to space farming.

- Submit the video and photos for the STEM challenge.
- Host a class showcase or share the results with community partners.

Submission Instructions:

1. Please submit your video by November 21, 2025 through the '25 Fall STEM Challenge Submission form linked here.
2. You will need to create a YouTube video link to submit your entry. Please follow the instructions below to upload your video and create a shareable link:

Go to YouTube.com and create a channel

1. Find the video camera icon in the top right corner
2. Click "Upload Video"
3. Click "Select File"
4. Select your video you would like to submit for the STEM Challenge
5. Please title your video as follows: "Team Class Name – Fall 25 STEM"
6. Scroll down to find "Audience" and select "Yes, this is for kids"
7. Click "Next"
8. On the "Video Elements" page, Click "Next"
9. On the "Checks" page, Click "Next"
10. On the "Visibility" page, select "Unlisted: Anyone with the video link can view your video" 12. Click "Save"
11. Copy video link on the "Video Published" page
12. Please paste your video link to the '25 Fall STEM Challenge Submission Form under "video link"

Please see the judging rubric below.

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Category		Points
Time Requirement	The video must be no longer than 5 minutes.	Up to 5 minutes - 5 points Over 6 minutes - 4 points Over 7 minutes - 3 points Over 8 minutes - 2 points Over 9 minutes - 1 point
Delivery	Student's voices and video quality were clear and at an appropriate volume.	15 points
Orderly Progress	Video flows from beginning to end with a clear introduction, main points, and conclusion.	20 points
Researched Information / Coverage of Subject	Video demonstrates knowledge and development of a hydroponic system, the benefits, and its limitations.	20 points
Creativity	Get creative with your video! We want to see more than just your students reading off a paper. This could include video editing, artistic elements, out of the box thinking, acting, costumes, storytelling narration, text overlays, animations, visuals, audience engagement, and showcasing curiosity.	20 points
Supportive Materials	Video must include photos or video footage of students throughout the challenge process.	20 points
TOTAL		100 Points

UP TO SIX BONUS POINTS: TWO FOR EACH ADDITIONAL PARTNER