



EarthBox[®] for Earth Day

Lesson Plan

Sustainable Agriculture ... One Box, One Classroom!



Explore, Discover, Inquire



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EarthBox® for Earth Day

Lesson Plan Sustainable Agriculture...one box, one classroom!

Focus: Sustainability

Time Required: 45 minutes

Objectives: Understand the science behind the EarthBox System
Learn how the EarthBox design nurtures plants
Learn the sustainable characteristics of the EarthBox
Collect and record data to test a prediction

Materials Required:

- 1 Ready to Grow Kit Item # S93903
- 1 pack Fisher Science Lettuce Seeds Item # S04167
- Hand outs: the Science Behind the EarthBox Explanation Sheet
- Hand outs: the Science Behind the EarthBox Worksheet
- Hand out: 1 Prediction Form
- Hand out: 1 Data Collection Form
- 1 Scissors
- 1 Scale

Teacher Preparation: Open the Ready to Grow Kit, read the instructions and be prepared to plant lettuce following the guidelines presented. Read the Science behind the EarthBox Explanation Sheet to become familiar with its components and how it works. Go over the entire lesson to become familiar with it. Make copies of the hand outs, be prepared to lay out all of the components of the EarthBox and to plant a Ready to Grow with lettuce seeds.



Procedures:

Step 1: Hand out *"The Science Behind the EarthBox® Explanation Sheet"*. Tell the group that each word typed in **bold** names a part of the system. Explain how you will select students to hold up parts of the EarthBox system and other students to read an explanation of how the 8 parts work so everyone can understand.

Step 2: Lay out, hold up and name the 8 parts of the EarthBox® system (the EarthBox® container, the screen, watering tube, cover, potting mix, dolomite, fertilizer and casters). Select 8 students to



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display the 8 parts during the upcoming reading. Tell them to lift up their part when the reader describes it. Assign each student a part.

Step 3: Select 7 students to read the 7 numbered sections of *"The Science Behind the EarthBox® Explanation Sheet"* aloud. Tell them to pause when they reach a word typed in **bold** to allow everyone to view the demonstrated part, learn its name, and function.

Step 4: Ask the readers and those demonstrating the parts to come to the front of the room to begin to read and demonstrate. After each part is covered, ask the students to circulate the parts around the room for all to see, touch and remember.

Step 5: Have the students complete the *"Understanding the Science Behind the EarthBox® Worksheet"*. Discuss and assess student comprehension of the effect of the EarthBox design on resource use and yield as it relates to sustainable agriculture. Collect all parts.

Step 6: Plant the Ready to Grow Kit with the lettuce seeds following the instructions. Place it outdoors in the sun. Assign a student to keep the reservoir filled with water throughout the growing season, that is until harvest time.

Guided Inquiry: Ask the students to think about a bunch of lettuce and to discuss how much it weighs. Then, ask them to predict how many grams of lettuce an EarthBox Ready to Grow Kit will produce? Pass the Prediction Form around the room for the students to write their names and their predictions on it. Keep the predictions.



Harvest Date

Step 1: Take the students outdoors. Bring a scissors. Have one student at a time, harvest one bunch of lettuce with the scissors. Have them cut it at its base as close to the mulch cover as possible. Have another student weigh the lettuce and yet another record the weight of each bunch on the data collection form.

Step 2: Ask the recorder to complete the data collection form and to announce the weight in grams.

Step 3: Discuss the actual yield with the students' predictions.





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The Science behind the EarthBox® Explanation Sheet

Section 1

The EarthBox® is a unique eco-friendly, container garden system. It allows the user to grow a multitude of vegetables, flowers and herbs without having a traditional garden, or garden site. Each component has a designated purpose(s). The **EarthBox container** is the central piece. It houses the plants and the other components. **The aeration screen**, located near the bottom of the EarthBox®, serves two very important functions. It holds the potting mix above the water reservoir, between the screen and the overflow hole, to make air available for the roots. It also prevents the potting mix from falling into the reservoir except beneath the two large, square cut outs in the corners where it becomes the conduit of water distribution through capillary action.

Section 2

Plants in EarthBoxes® get their water from a bottom reservoir that is fed through a 12 inch **watering tube** secured inside a circular hole in the aeration screen at the bottom and slipped through a hole in the mulch cover on the top. A recessed overflow hole, located $\frac{1}{2}$ inch below the aeration screen in the front of the box, drains excess water to secure the space reserved for air and to eliminate the possibility of overwatering.

Section 3

To maximize the effectiveness of capillary action, the **potting mix** used in an EarthBox® should be light and airy. Only then will cohesion, the force that holds individual water molecules together, and adhesion, the force that makes water molecules stick to other surfaces, evenly distribute water to the roots of the plants. Capillary action begins in the system when water adheres to small particles of the potting mix that lie beneath the cut out squares in the aeration screen. As water molecules stick together and enter the potting mix, they also adhere to the particles of potting mix. Together, the two properties of adhesion and cohesion draw a flow of water from the reservoir into the mix until all of the potting mix is wet. The roots draw the water as they need it through capillary action. As the roots absorb water, more is pulled up from the reservoir. When the reservoir is kept full, the plants will always have the proper amount of water, never too little, nor too much.

Section 4

Plants need nutrients to grow. Since the potting mix used in the EarthBox is sterile, the system requires a single, seasonal, application of nutrient-rich **fertilizer** for the plants to grow. Therefore, at the beginning of each season, the fertilizer strip is placed on top of the potting mix. Throughout the season, capillary action ensures the regular flow of water over the fertilizer. Using the gradient system, the fertilizer diffuses from a higher concentration to a lower



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concentration. During this process, the roots uptake the nutrients as they become available, and more importantly, when they need them.

Most edible crops prefer a sweet growing medium with a neutral pH of 7. Since the natural 5.5 pH of the peat-based potting medium is 5.5, dolomite is added to raise the pH to 6.5-7. The dolomite also provides an extra source of calcium for fruit development and provides other trace minerals plants need to grow.

Section 5

The **plastic mulch cover** is another important element of the EarthBox® system. It serves several critical functions that control the EarthBox® environment. The cover:

- keeps rain out of the EarthBox®. If rain were to fall on the potting mix, it might deliver too much fertilizer to the plants, or give the plants more water than needed.
- reduces evaporation. The cover prevents the release of water into the air and returns it to the system through condensation. This can be critical to plant life in certain environments.
- helps to keep insects and other pests out of the potting mix.
- prevents weeds from growing in the EarthBox®.
- conserves energy. By reducing the amount of water a crop needs, it reduces the amount of energy used to transport the lesser amount.
- makes the EarthBox an ideal tool for conducting experiments.

Section 6

While the EarthBox® is capable of growing virtually any type of plant, the number of each type of plant that can be successfully grown in it, differs. The number of plants is determined by the overall size of the plants, their nutritional needs, and the size of the root balls. For example, after extensive research, scientists determined that two tomato plants, produce the highest yield and the healthiest plant.

No matter the weight of a planted EarthBox Ready to Grow Kit, the **casters** make it easy to move it in and out of a classroom, or in and out of sunlight. They also make it easy to remove a diseased or infested container to prevent further infestation or disease.

Section 7

EarthBox technology produces sustainable results:

- The EarthBox® itself is UV protected, reusable and recyclable.
- The potting mix is re-useable for 8-9 seasons.
- Calculated, seasonal applications reduce fertilizer requirements.
- The mulch cover prevents runoff and ground water pollution
- The system reduces the amount of water needed.

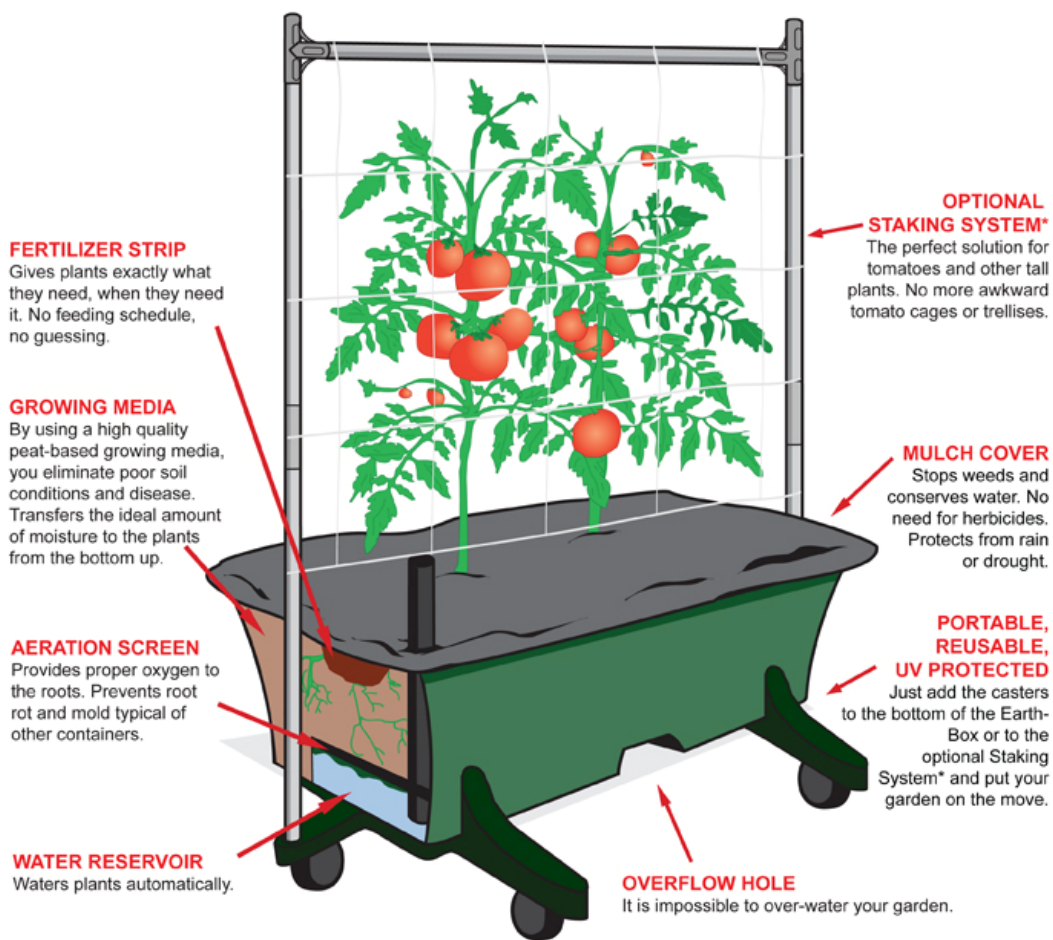


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- The reduced amount of water conserves energy.
- EarthBox® enhances local food security because healthy crops produce high yields on balconies, decks, rooftops and backyards, on pavement and concrete, anywhere there is 6-8 hours of light.
- Growing locally reduces
 - food fuel dollars associated with transportation
 - the likelihood of importing pests and diseases
 - the damaging effects to the environment associated with Ag for Export:
 - erosion and climate change

“Food and shelter are integral to good health and survival...Integrating sustainable food production using the EarthBox Container Garden System into green building design reduces our carbon footprint and increases the availability, accessibility and affordability of healthy produce which leads to an overall healthier community and environment”.

Michelle Kaufmann, AIA, LEED®, AP





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The Science behind the EarthBox® Worksheet

1. Draw an EarthBox® to illustrate the flow of water within the container:

2. Give two reasons why the overflow hole is important to the science of the EarthBox®:

3. Name and explain the system that provides the plants with nutrients:

4. What significant plant growth requirements does the EarthBox® meet?

5. Name three sustainable characteristics of the EarthBox®:



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The EarthBox® Harvest Data Form

HYPOTHESIS: *How much lettuce will one Ready to Grow Kit produce?*

Total Harvest in grams Table (g)

Plant #1	Plant #2	Plant #3	Plant #4	Plant #5	Plant #6	Plant #7	Plant #8
g	g	g	g	g	g	g	g

Total Harvest Weight

_____ grams

