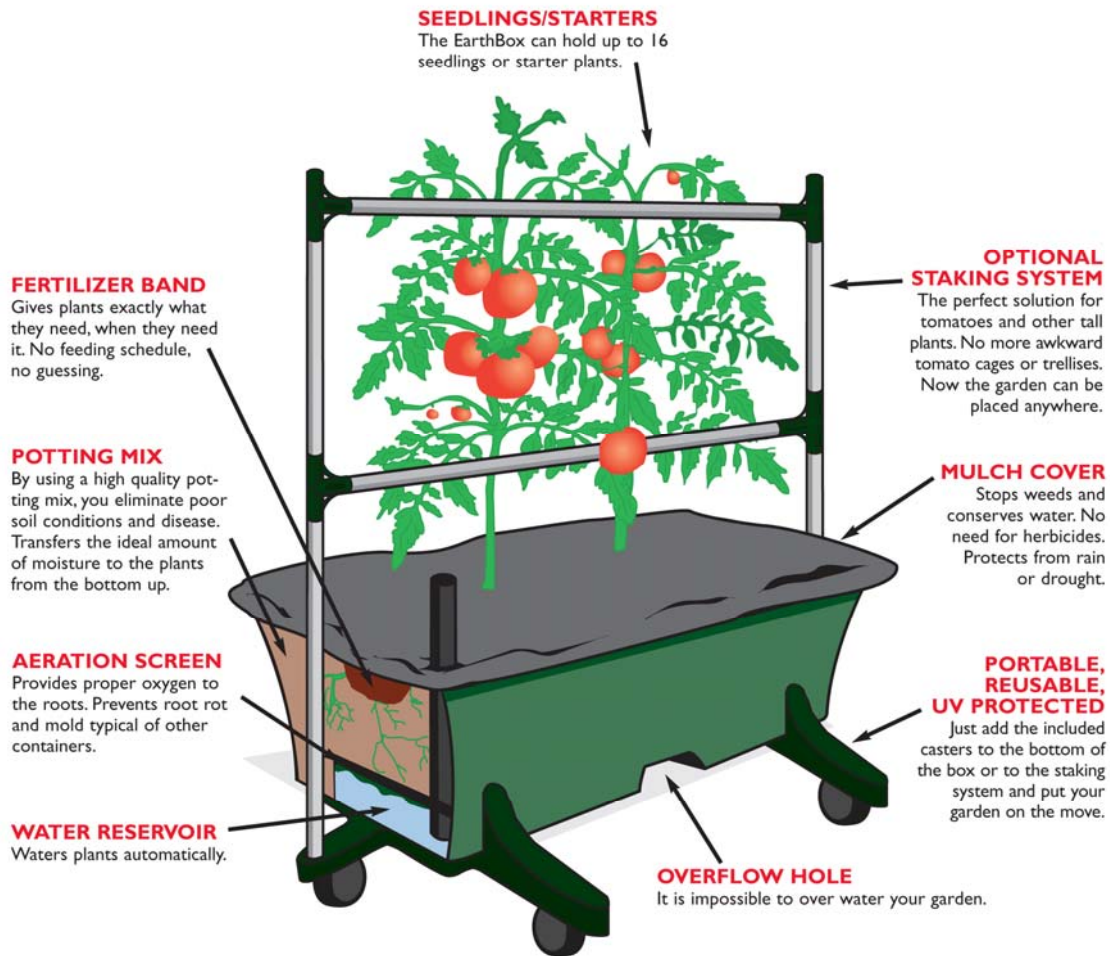


The Science Behind the EarthBox



EarthBoxes are a unique sustainable container gardening system that allow the user to grow a multitude of vegetables and flowers without having a traditional garden. EarthBoxes use scientific principles and technology to grow the highest yield of crops in the smallest amount of space using reduced amounts of water and fertilizer. Each EarthBox component was engineered to meet the needs of plants in a sustainable environment.

The black plastic aeration screen in the bottom serves a very important function. Not only does it keep the potting mix from falling into the water reservoir, but it also holds the potting mix far enough above the water to allow an open area that holds the air supply required by the plants to grow. By design, some potting mix does fall into the water in two places – through the two large, square cut outs in the corners of the screen. It falls into these holes and fills them up.

EarthBoxes aren't watered the same way that plants in a traditional garden are watered. Instead of receiving water from above, plants in EarthBoxes get their water from a reservoir that

lies below the aeration screen. It gets water through a water tube that extends from above the EarthBox and reaches down into the reservoir. The recessed overflow hole on the underside of the EarthBox prevents the addition of too much water to the reservoir. Once the water has reached a certain level, any additional water will flow out of the overflow hole. This makes it impossible to over-water the plants in an EarthBox and secures the area reserved for air.

If neither the plants nor the potting mix are ever directly watered, then how does the potting mix stay wet and how do the plants get the water they need? The potting mix in the two corners of the EarthBox that is in contact with the water acts as a wick and becomes saturated with water. Water then moves up through the dry potting mix by the principal of capillary action. Capillary action involves two important properties of water – adhesion and cohesion. Cohesion is the force that holds individual water molecules together, and adhesion is the force that makes water molecules stick to other surfaces. Water begins adhering to small particles of the potting mix, and as it does so it slowly works into the small spaces between potting mix particles. Water molecules stick together, so as water adheres to additional particles of potting mix, cohesion allows for the continuous drawing of water from the water reservoir. Eventually, all of the potting mix is wet, and then the plants are able to use as much water as they need. When a plant absorbs water from the potting mix, more water is pulled up from the reservoir. As long as the reservoir is kept full, the plant will always have the proper amount of water, never too little, nor too much.

Most people who farm or grow plants in their gardens add fertilizer a few times a year. Fertilizer helps the plants grow larger and helps to produce more flowers and larger vegetables. It provides plants with extra nutrients that are necessary for strong plant growth and high crop yield. During the setup of the EarthBox, a bag of fertilizer is placed in a long strip on top of the potting mix. You may wonder how the roots of plants get the fertilizer when it is placed on top of the potting mix. Just like water is pulled from the reservoir, fertilizer is pulled from the top of the potting mix to the roots of the plant as it needs it. Water, fertilizer, and molecules in general always diffuse, or move, from areas of high concentration to areas of low concentration. The slow-release, granular fertilizer placed on top of the potting mix provides adequate plant nutrition for the entire growing season! Dolomite is also added to the potting mix. Dolomite helps make the potting mix less acidic and provides extra calcium and magnesium, resulting in better growing conditions for many plants.

The fitted mulch cover is another important element of the EarthBox, serving several critical functions that control the EarthBox environment:

- It keeps rain out of the EarthBox. If rain fell on the potting mix, it might deliver too much fertilizer to the plants which could injure or kill them. It might also give the plants more water than they need, which could also harm them.
- It helps prevent evaporation from the EarthBox. Evaporation happens when water is lost to the air. The plastic cover helps to keep the water in the EarthBox so it can be used by the plants instead of lost to the air. EarthBoxes are used in some countries where water is scarce. This conservation is very important to people living in these areas.
- It also saves water because some water that does evaporate from the potting mix condenses on the bottom of the plastic cover. This means that the water vapor in the air collects in small droplets on the bottom of the plastic cover. When the drops are large enough, they fall back onto the potting mix in the EarthBox.
- It helps to keep insects and other pests out of the potting mix.
- It prevents weeds from growing in the EarthBox.
- It helps to regulate the temperature of the EarthBox with a two sided cover that offers a white side for users in hot climates and a black side for users in cooler climates.
- It conserves energy. By using less water, the EarthBox reduces the amount of energy required of a water delivery system, thereby reducing the cost as well.

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 varies. This is primarily due to the nutritional requirements of the different types of plants. For example, the EarthBox's design permits two tomato plants to be grown in it. More tomato plants can fit in the EarthBox, however they will not

receive adequate nutrition from the fertilizer and as a result will not yield a greater tomato harvest than the recommended two plants.

The sustainable technology of the **EarthBox** allows plants to control the uptake of water and nutrients from the potting mix and fertilizer strip, while at the same time conserving water and fertilizer and eliminating excess fertilizer runoff when compared to traditional gardening. The success of growing plants in an **EarthBox** is based on numerous scientific principles which can be investigated in further detail in lesson and lab activities in the **EarthBox** Curriculum Support Package.