

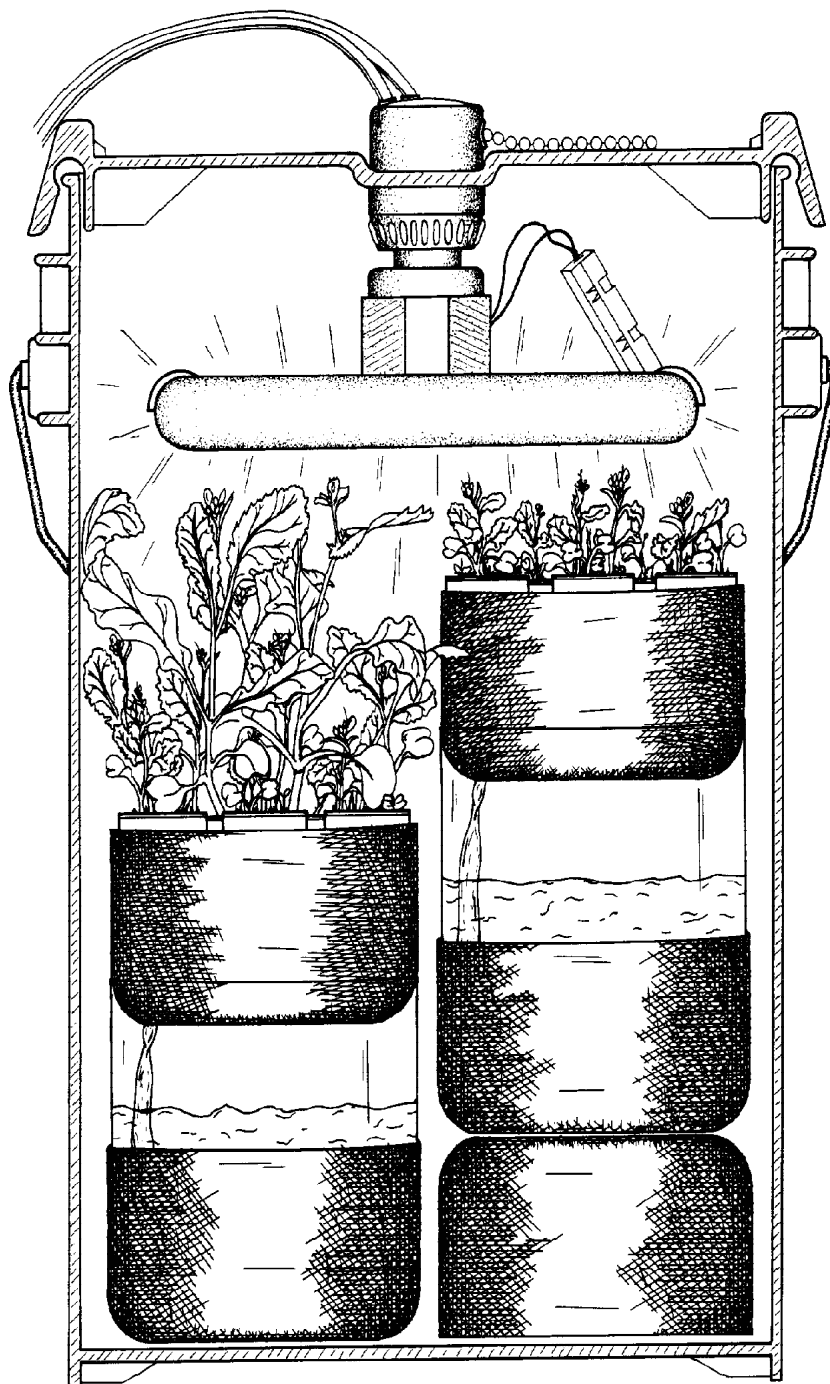


GrowBuckets and Bottle Reservoirs

Much of the fun in science comes from creating, designing and running experiments. The Bottle Biology Project and Wisconsin Fast Plants teams have been collaborating in the playful and serious task of designing growing systems for small plants (especially Fast Plants) made out of materials from the trash can. This article presents some of our latest ideas for you to consider and improve upon. What we describe below are working prototypes. We hope that you and your students will modify and improve upon the ideas presented. P.S. Let us know what your ideas and successful designs are!

GrowBuckets

Finding the right lighting conditions for optimum plant growth can be tricky. Plant researchers sometimes rely on expensive growth chambers to get the right conditions for their experiments. We have recently discovered that the new energy saver circular fluorescent light bulbs fit nicely into five gallon plastic buckets. These bulbs produce, on average, the same amount of light as a 75 watt incandescent bulb, but with less heat production. With several holes cut for ventilation and a door for access, we have been able to grow Fast Plants in these buckets in much the same way we have grown plants under banks of regular 4-foot fluorescent bulbs.



GrowBucket Tips

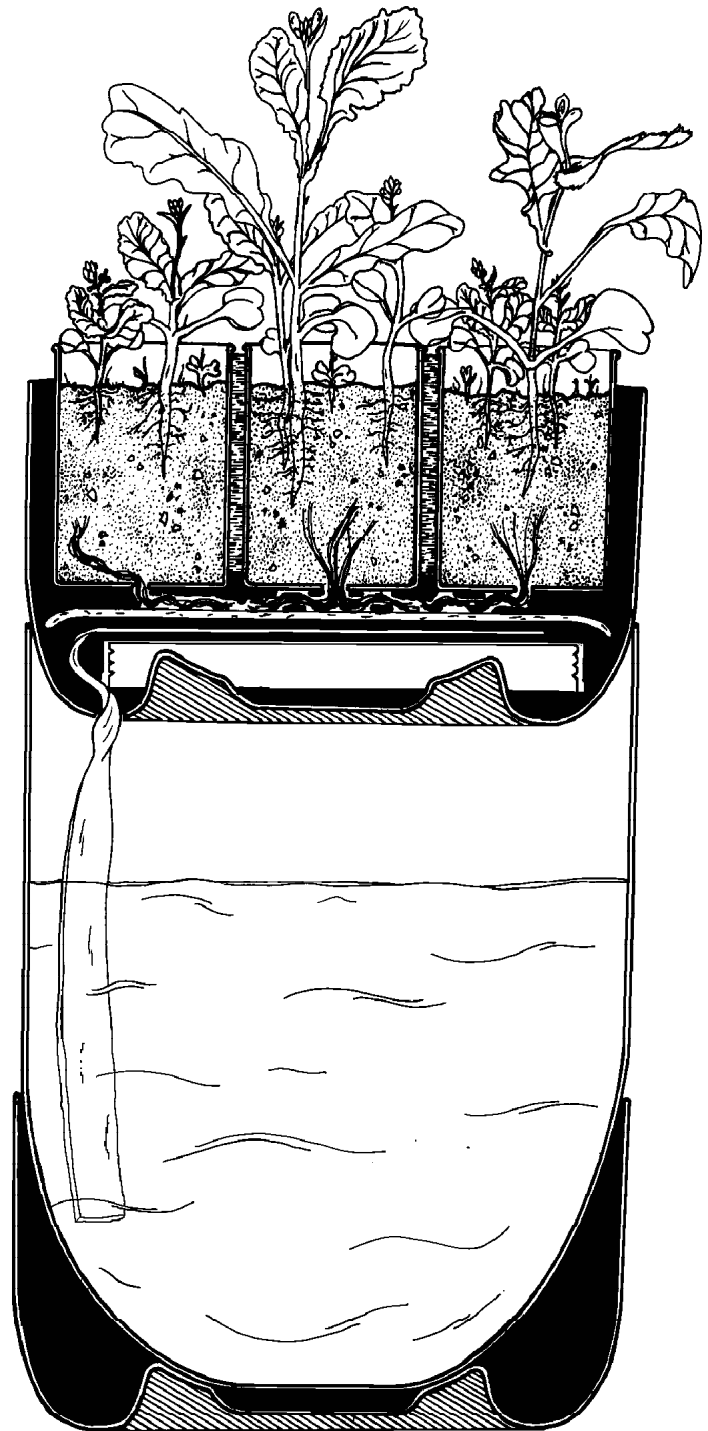
Cutting Buckets: Five gallon plastic buckets can be cut a number of different ways. If you are making only a few buckets, they can be cut with a heavy duty utility knife or a key hole saw. It is frequently easier to start a cut by drilling a hole with either a hand or electric drill at the beginning of the line you are going to cut. For production of a many bucket constructions you may prefer to use a small electric hand saw such as a jig or saber saw.

Ventilation: It is critical that the air temperature in the bucket be as close to room temperature (18° to 24°C) as possible. Cut two 7.5 cm diameter holes opposite each other on the bottom of the side of the bucket. Cut another pair of holes opposite each other on either side of the lid. Leave as much space as possible between the ventilation holes on the lid to allow room for mounting the light-bulb.

Mounting the bulb: The circular fluorescent bulb is mounted to the lid of the bucket. Cut a hole into the center of the lid which is just big enough to accept the metal shaft of a two piece porcelain utility light bulb socket. Connect a light-weight electrical wire (lamp cord) with plug to the socket. Screw the socket together with the plastic lid sandwiched between the two porcelain pieces. Screw the bulb into the socket. You will need to use a Lights of America 30 watt circular energy saver bulb to provide adequate light for Fast Plants (see WFPID E-34-94).

Making a door: It is possible to access plants in a bucket by removing the bucket lid. However, it is easier to make a door on the side of the bucket. Our doors measure 20 cm wide by 26 cm tall and go to the bottom of the bucket. A hinge can be made from duct tape or small metal hinges can be screwed into the plastic bucket wall. Similarly, duct tape can be used to keep the door closed, or a small hook-and-eye can be installed. To allow for the maximum amount of reflected light it is best to keep the door closed when plants are not being moved or viewed.

Positioning plants: When plants are placed in the bucket it is critical that they get as much light as possible. This is especially true for Fast Plants. We recommend that plant containers be propped up until the tops of the plants are two to four centimeters from the bulb.



Bottle Reservoirs

Small plants (such as Fast Plants) can be grown in small containers as long as they are watered regularly. This task can be made easier using a continuous water wicking system. In the sample design shown above, empty 35 mm film cans are used as pots and parts from plastic soda bottles serve as water reservoirs. We have found that Fast Plants can be left unattended for two to four days with this system.

Bottle Reservoir Tips

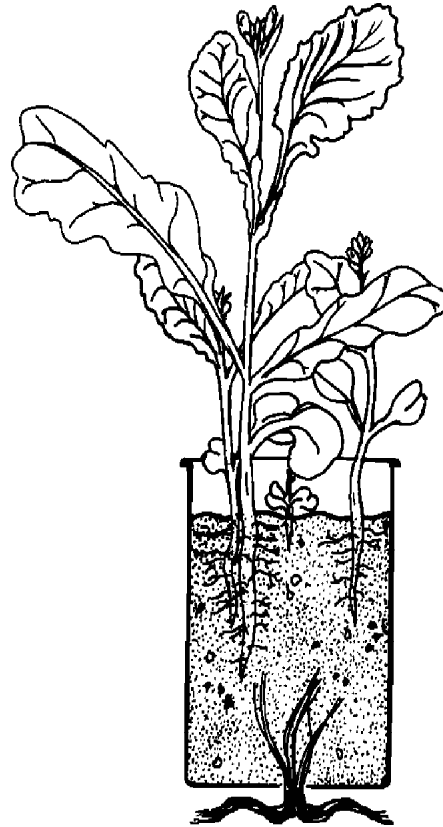
Bottle Preparation: The labels and bases on plastic soda bottles can be removed by filling the bottle with hot (50° - 65°C) water. After several seconds the heat sensitive glue will soften allowing the label to be peeled off, and/or the base twisted off. For this construction you will need one bottle with the label removed. Cut the top off of this delabeled bottle. For use in GrowBuckets we usually leave only 4 cm of the side attached to the bottom of the bottle. This makes the reservoir short enough to keep plants in the reservoir from hitting the lid of the bucket. Green bottles, as compared to clear bottles, work well for these reservoirs because they reduce the growth of algae.

You will also need the base from a second bottle. It is possible to substitute certain plastic containers (such as small cottage or cream cheese cups) for soda bottle bases. Place this base, bottom down, into the top opening of the first bottle. Into the base place a plastic jar lid (the lids from peanut butter containers are great) or petri dish to act as a platform for the plant pots.

Wicks: Pellon™, a fabric interfacing material, functions well as a wick for water. Before being used as a wick, pellow must first be washed on delicate cycle with soap and bleach to remove flame retardants, then line dry. Cut two pieces of pellow wick. The first is a strip 1 cm wide which runs from the bottom of the reservoir through a hole in the upper bottle base and well over the lid platform. The second wick is cut as a disk or square to fit the platform, and is placed over the strip wick on top of the lid. Presaturate the wicks before use by repeatedly squeezing them underwater. Water will move along a wick only if it is presaturated!

Film Can Plant Pots: Empty **35 mm film cans** make wonderful pots for Fast Plants and other small plants (mosses, babies tears, and miniature african violets.). Camera and film development stores discard large quantities of film cans. Ask to have them saved for you! For drainage and wicking, drill or poke a small hole (5 mm) in the center of the bottom of the can.

Thick unpolished **cotton string** (such as butcher's string) cut to about 4 cm in length works well as a wick for these film can pots. Presaturate the string by squeezing it under water. Frequently, a small amount of soap added to the water will facilitate wetting. Push a loop string half way through the hole in the bottom of



the can. When the can is placed in the reservoir this cotton string wick should make solid contact with the pellow disk wick on top of the lid/dish.

Fast Plants in Film Cans: A film can has about four times the volume of a single cell in a Fast Plant quad. From this fact it is possible to extrapolate from a Fast Plant manual how to grow Fast Plants in film cans. Four plants can be grown in a film can. N-P-K slow release fertilizer pellets can be used at a rate of 12 pellets per can. Fertilization can also be achieved by adding a few milliliters of a one tablespoon/gallon solution of Peter's fertilizer, 20-20-20 (N-P-K), to the top of each film can at three, seven, and fourteen days. Jiffy Mix, a commercial potting mix, has worked well for us with Fast Plants.

A Word of Wisdom: Through the use of recyclable materials it is possible to make many inexpensive educational materials but, variations in local materials may cause problems. We have found that it is always best to do a test run with any new construction before you use in the classroom or other such situation when first-time success can make-or-break an activity!