The Eave Trough Garden

A Gardening Hint

From ECHO

Educational Concerns for Hunger Organization
THE EAVE TROUGH GARDEN
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Revised May 1993

The goal of ECHO's rooftop gardening project is to develop gardens that are:

• exceptionally lightweight,
• inexpensive, and
• uncomplicated to build and maintain.

Although we have Third World cities in mind, we find that many of these techniques can be adapted for use in our own country. The eave trough garden is a prime example.

Can you envision one or several of these on your balcony, at the edge of your driveway, on the garage roof or anywhere it receives sun and can be easily reached for watering? See photo on Page 2. You will not only enjoy great vegetables and showy flowers, but also have a conversation piece that will be the talk of the neighborhood.

First A Few Bends And Cuts To The Eave Trough

Shop around for a good price on aluminum eave troughs. One that I bought for my parents in a small town in Ohio cost $8, but I can find them for $4.30 in Fort Myers. They come in white or brown. Brown might be more attractive in certain settings, but I have always chosen white. The darker color might absorb too much sunlight and overheat the system.

Cut the eave trough to fit the space available. For most uses I cut them in the middle to make two, 5-foot troughs. We left our first units 10 feet long, but they were too awkward to move around.

You can cut the trough with tin snips, but the curved parts will not cut straight. See Figure I on Page 3. A few rough edges on the ends hurt nothing, but for appearance sake the best way is to cut through the curved side of the trough with a fine-tooth hacksaw blade. Then the other side and the bottom, which are flat, can be easily cut with tin snips.
Don’t worry if the first cuts are not especially neat. Ours were not. But it is hardly noticeable when the trough is filled with beautiful plants.

Next you need to bend the bottom of both ends upward so the trough will hold about 1/2 inch of water when level. With a little practice you can bend the ends neatly. Be careful not to cause a tear that will allow water to run out. It is difficult to describe in words, but here are some hints based on ECHO's work.

There is no problem bending the middle part of the end upward. But what do you do when you get to the right and left sides of the trough? We bend the flat side outward until there is only a very small angle between that side and the bottom. Now the bottom can be bent upward easily on that side. It should form about a 1/2 inch deep rim. Next we
push the side back to its original position, to form a right angle again with the bottom. You will note that the bottom has now been shortened by 1/2 inch because you bent that much of it upward to form the rim.

![Figure I.](image)

So the side now protrudes by that amount. We take advantage of this to gain extra structural strength. With a pair of pliers, bend the protruding part inward until it is resting against the 1/2 inch bottom edge. Now repeat the process with the other irregularly shaped side. The process is the same, but it will not be quite as neat because of its irregular shape.

![Figure II.](image)
Getting The Trough Ready

For a 5-foot trough you will need two empty flower pots, which can be either square or round. Position them so that they divide the length of the trough into thirds. The centers of the pots will be approximately 20 inches from each end and from each other. Experience has shown us that greater distances between the pots lead to problems. All of the watering of the garden will be done through these two pots. They will also serve to monitor the water level.

If you are handy at working with wood, you may want to cut out a piece to attach at each end to keep potting mix from falling out. An easier, though less elegant, approach is to simply place two flower pots at the ends. You can fill these pots and plant in them. You will not be using the two end pots for either monitoring the water level nor for adding water. There is usually a spot between the pot and the end where you can readily monitor the water level; and water added through an empty pot so near the end runs right out of the container. If you decide to place nothing at the ends, slop the soil gradually to the end and very little will run out. You will find that plants grown near the end in this much shallower spot do not do as well as those in deeper soil.

Sometimes we use four thick pieces of wire for extra strength. One wire is inserted in each of the empty flower pots, through small holes that we drill through the pots and the two sides of the trough. See Figure II. Then the ends of the wire are bent to hold it in place. This keeps the sides from pushing outward as the potting mix is added or when they are moved. This step is not essential, but makes for a nicer garden.

Selecting The Potting Mix

You may have heard it said that more plants are killed by overwatering than by underwatering. There is a lot of truth to that. Because there is a 1/2 inch pool of water sitting in the bottom of this garden, the soil can be very soggy indeed. We have never used ordinary garden soil in an eave trough garden. I suspect that if we did the plants would be harmed
from too much water. It would also be too heavy to carry easily.

The key is to make sure there are plenty of air spaces between particles of the potting mix. There is no one right way to do it. Sometimes I have mixed equal amounts of pearlite (sold at any nursery because it helps make the soil more airy) and compost. Sometimes I have mixed 1/3 pearlite, 1/3 composted cow manure (bought in bags at nurseries), and 1/3 of some other kind of light mix. You may want to make the bottom half from wood chips and the top half from one of these mixtures.

It is very important that the material you use has lots of the following:

1. space for air,
2. either organic or commercial fertilizer, and
3. some organic material.

Now fill the trough clear to the top if you will be planting seeds or almost to the top to allow for soil that will be added from the root ball.
of transplanted plants. Normally, a space is left between the top of a container and the soil for ease of watering. This is not necessary in the eave spout gardens because you will be watering only through the two center pots. You want all of the root volume you can get, so fill it to the brim.

At my home I have a beautiful trough of impatiens that is now 14-months old. I did none of the above steps except for cutting the trough to 5 feet and bending the ends. I purchased six impatiens in 4-inch pots, removed the pots, and spread the plants at equal distances in the tray, just setting the root balls on the bottom of the trough. Then I packed fresh pine needles in around them to keep the plants standing upright. Every second or third watering I include some hydroponic fertilizer. They have been wonderful; a blaze of color. They only drawback is that they must be watered more frequently because pine needles do not hold water.

A similar approach has worked equally well in a six-month trial. I positioned the 4-inch root balls as above, then filled in between with wood chips. The chips seem to hold a bit more water than do the pine needles.

We need to do more experiments with this simple system. If we had not used a complete hydroponic fertilizer they would probably not have done as well. On the other hand, if the original plants were growing in a complete compost, the compost might have provided enough of the minor elements to keep the flowers blooming. As you can see, there are a lot of unanswered questions and a lot of experiments you can do.

We lost a lot of onion sets to rot, because even these airy mixes were too wet. In two trials now we have had almost 100% success planting onions in pure wood chips. Fill the tray half-full of wood chips. Sprinkle one tablespoon of dolimitic limestone and three tablespoons of 10/10/10 fertilizer with micronutrients over the chips and stir gently with your finger. Position the onions sets, then fill the rest of the way with more wood chips. Repeat the fertilizer and dolomite application on top and water enough to wet the entire volume. Add more water whenever the reserve in the bottom of the tray is gone.
If it rains a great deal, the fertilizer may be washed away. If this happens, or the onions fail to thrive, you might water occasionally with a fertilizer like Miracle Grow.

**Caring For the Garden**

This is not a garden that you can leave for a week while you travel. Depending on the plant size, the temperature, and wind speed, you may need to water it daily. Even in mild weather it needs to be watered at least every other day. Check it especially when there is a lot of wind.

After the plants have grown to some size, you may begin running low on nutrients. You can water each time with water containing a tablespoon of one of the common soluble fertilizers sold in nurseries everywhere, such a Miracle Grow. These fertilizers will provide all the major nutrients, nitrogen, phosphorous and potassium, and micronutrients that most plants need. The reason we like to have some composted organic material in each trough is that the compost will provide most of these lesser nutrients as needed. These will probably also be present in a complete hydroponic fertilizer, if you chose one of those.

Be careful though, because may fertilizers, including some of the soluble fertilizers, may be lacking in two elements needed in intermediate amounts: calcium and magnesium. Another source of calcium and magnesium is dolomitic limestone, sometimes called dolomite. If you suspect a deficiency, it might be solved by placing a few tablespoons of dolomite in the empty center pots.

**What Has ECHO Grown?**

We have the best success with the smaller temperate vegetables. Leaf lettuce (many kinds), radishes, green onions, kohlrabi, sugar snap peas, mustard greens, basil, beets, impatiens, pansies, small marigold varieties, alyssum and many kinds of herbs have all done well. By planting only two plants per segment, between each of the empty pots, you can grow larger plants like celery, egg plant and okra. (The ancestor
of celery is a bog plant, so it is not surprising that it responds so well to all that moisture and fertility). Larger plants will require a trellis to hold them upright.

A hint for Florida gardeners. We retire most of our eave trough gardens until fall returns. During the summer it is so hot that most temperate plants do not do well. Though ECHO has many tropical vegetables that will produce in summer, they tend to be large. The combined high heat and large size mean that plants must often be watered twice a day.

Where Do You Put The Eave Troughs?

The eave trough gardens can be laid on any flat surface such as a balcony, driveway, sidewalk, rooftop, and flower bed. You may want to construct an A-frame to hold several at key spots in your yard. See photo on Page 10. The photo on Page 5 shows a platform garden at my own home on top of which are two wading pool gardens. (See gardening hint, "Wading Pool Gardens"). At the end I positioned cement blocks and a couple bricks to hold a series of four eave trough gardens.

How Does It Work? - A Little History

(Note: You do not need to read this section to make successful gardens. It is presented to give deeper understanding into why and how it works for those who wish to pursue it further.)

If you have ever looked through a book on hydroponic gardening, you know that many of the smaller commercial vegetables are grown in troughs about the size of an eave spout. The main difference is that they are longer and much more expensive. Their operation is also complex, requiring special hydroponic fertilizers and automated pumps.

Vegetables and flowers do not necessarily require a large volume of soil for their roots, as long as a constant supply of water, nutrients and air is
provided. In one hydroponic system, called nutrient film hydroponics, a solution of nutrients flows constantly in a thin layer through the trough. Roots form a dense carpet along the bottom of the trough, absorbing water, nutrients and air as needed.

We wondered how some of these hydroponic techniques could be adapted to meet our special requirements? The commercial hydroponic troughs were way too expensive. So were the pumps and the specialized hydroponic fertilizers.

The key to simplifying these came in a method developed in Taiwan, called non-recirculating hydroponics. Their method still involved the special fertilizers and it was much too heavy. Plants were grown on a styrofoam sheet with their roots dangling below in a 2-feet deep container of water and fertilizer.

The new concept for us was that plants can actually develop two kinds of roots: air roots and water/nutrient roots. That is why their somewhat simplified method worked without any pumps. As the roots grow the operators dropped the water level. The roots dangling in water developed into specialized roots for taking up water and nutrients. Those in the air space between the suspending sheet and the water developed into specialized air roots.

Scientists who developed this method stress that water/nutrient roots could change into air roots if the water level dropped. But air roots cannot change back into water/nutrient roots. I found the truth of this the hard way when the intern in charge of our first tank left for Christmas vacation. I had not known that he had gradually been lowering the water level. So I filled it up to the original level. Within 24 hours the beautiful vines looked like they had been through a frost. In a few more days they were dead.

We began experimenting with smaller and smaller containers until the two-foot deep ones had been replaced with an eave spout. We bent the ends of the eave spout so it would hold about 1/2 inch of water and hydroponic fertilizer. A piece of wood was made to fit on the top of the eave spout and plants grown in special pots, developed for hydroponic gardening, were set into holes cut into the wood. Air roots developed in
the space above the water and water/nutrient roots developed in the water.

This was still too complex for our purposes and mosquitoes were developing in the water. One further simplification brought us to the first eave trough garden that resembles our present methods. A very course material, such a pearlite, with a lot of air spaces between the

ECHO Eave Trough Gardens on an A-Frame
particles, was used to fill the eave spout halfway to the top. A good organic potting mix combined with an equal volume of perlite made up the rest of the "soil". The latter is used in nursery mixes because it decreases the amount of water the soil will hold and increases the amount of air spaces.

Water is added through the empty 4-inch pots, at least once daily, so that there is 1/2 inch of water in the bottom of the eave trough. We have attempted to create a situation in which specialized air roots can develop in the growing medium and water nutrient roots in the swamp below. We have not done any research to show whether indeed the two kinds of roots develop. It is enough for our purposes that we can grow a wide variety of healthy plants in a system that is inexpensive, can be built quickly, can operate without hydroponic fertilizers and uses no fancy pumping system.

Where Do You Go From Here?

We are trying new materials, fertilizers, manures, and plants every year. There is still a lot to be learned.

We will be very interested to hear how your eave trough gardens worked. What special uses did you find for them? What vegetables or flowers did well? What flopped? Maybe you can even send us a picture. We will probably not find time for a personal reply, but be assured that we will eagerly read your report.

Happy Gardening!
ECHO'S PURPOSE

ECHO, Educational Concerns for Hunger Organization, was begun "...for equipping the Christians for the work of service, to the building up of the body of Christ." Ephesians 4:12

ECHO's primary mandate is to strengthen the ministry of missionaries and national churches that work with subsistence farmers and urban gardeners overseas. Assistance is also offered to many other organizations, such as the Peace Corps, who are doing agricultural work.

ECHO's primary activities are to:

1) summarize new ideas and agricultural information in a technical newsletter;

2) answer technical questions from overseas;

3) send seeds of underutilized and hard-to-find tropical food plants;

4) research appropriate technology applications, agricultural techniques, tropical plants (food, forage, cover crops, ...), and other issues important in small-scale, tropical agriculture;

5) provide short-term training and consultation in project planning for development workers; and

6) offer various training opportunities in small-scale farming to college students and graduates.

Guided by a Board of Trustees, ECHO and its services have evolved in response to the felt needs of missionaries and development workers in ECHO's network.

For more information on how ECHO is helping to ease hunger around the world, please feel free to contact us. Our address is located on the back of this gardening hint.
The ECHO Garden Hint Series

A collection of publications designed to share some of ECHO's innovative gardening techniques.

*Shallow Bed Gardening
*Hill Culture
*Using Cola Cans in Your Soil Mix
*Growing Wick Gardens
*The Wading Pool Garden
*The Eave Trough Garden
*The No-Till Garden

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