Overview of Above-Ground Gardening

SOME CRITERIA FOR ABOVE-GROUND GARDENS. (1) They must be made from **local materials,** not from something imported into the country. (2) They must be **inexpensive** to construct, preferably using recycled materials approaching no cost at all. (3) They must have a very **low weight** per area of growing space (unless located on the ground). (4) The emphasis should be on obtaining satisfactory production with minimal inputs, rather than maximum possible production with high inputs (which is the usual goal of hydroponics). (5) **No instruments or analyses** should be needed for routine operation. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch17ov.htm#Table)

A LOOK AT FOUR ABOVE-GROUND GARDENING METHODS. [Please note: One inch (") = 2.54 cm.]

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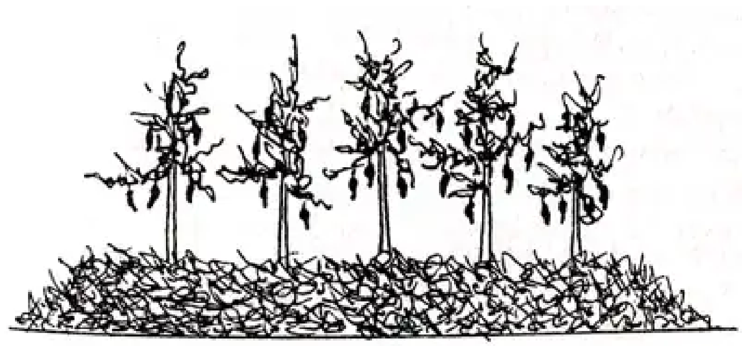
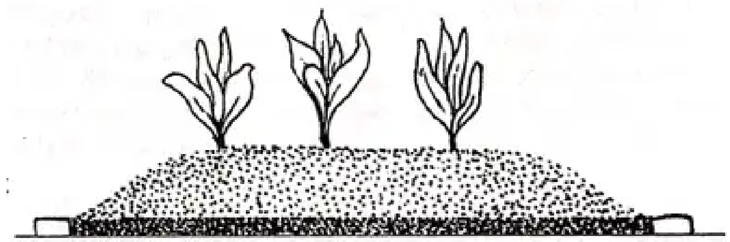
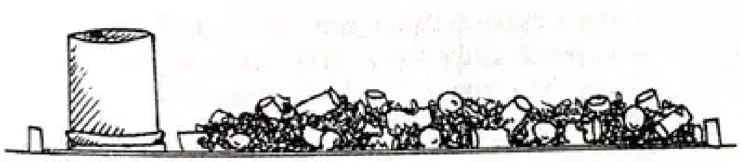
The Shallow Bed Garden is a 3-6" bed of compost. To keep weight to a minimum, no soil is used. If compost is not available (a likely situation), plants can be successfully grown in fresh organic matter of many kinds. Such beds are fertilized and covered with at least a thin (/resources/c4069fc4-92fc-4ca4-8210-58c15f31f9fd)covering of compost or soil. Almost any vegetable can be grown in



shallow beds. Once the beds are established, they are like regular gardens except in their need for more frequent watering.

The Shallow Pool Garden consists of a shallow pool of water 0.5-3" deep. Usually a sheet of plastic of the desired size is formed into a pool by laying sticks under each of the sides. Shallow beds made of any material that does not tend to become waterlogged are then built in the pool, extending at least 2" above the water line. The length of time between waterings can be extended by making a bucket waterer. [To make a bucket waterer, drill a 3/8" hole into the tight-fitting lid of a 5-gallon plastic bucket, about 1 inch from the edge of the lid. Fill the bucket with water (optionally containing a soluble fertilizer) and place it upside down in a cleared spot in the "pool."] Place a stick under the bucket lid at the point nearest the hole to allow air to enter under the bucket. This results in a constant shallow pool of nutrient solution in the bed, the depth of which is determined by how much the stick raises the edge of the bucket.





(/resources/44cf981f-70c8-434f-8cfe-588d1c68a48a)The Wick Garden consists of a piece of polyester cloth (the "wick") laid out on a flat area in the shape of the desired garden and a 5-gallon bucket waterer (see above) placed directly on the wick. Set the root balls (the roots and soil attached to plants in their starting containers) of transplants directly on the wick. Finish the beds by filling in around the plants to a depth of 3-6" with some extremely airy material such as pine needles, pieces of coconut husk, or even cola cans. It is important that this material be something that will not become waterlogged. Leave a section of the cloth clear to hold the upside-down bucket. The wicking action of the cloth spreads water and nutrients to the roots, which grow above and below the surface of the cloth. Sometimes the cloth is first covered with a thin layer (0.5-1") of compost or potting soil. Best results are found with short or trailing vegetables and herbs, such as onions, radishes, lettuce and mint.

Tire Gardens. The tire gardens are portable gardens that can literally go almost anywhere. The garden is made from an old tire and a small sheet of plastic film (e.g. a garbage bag). Construction is simple and elegant. Lay a tire flat on the ground.

Note that the top rim is a mirror image of the bottom rim. With a knife or machete, cut off the top rim. Place a piece of plastic inside the tire on the bottom rim, large enough so that an inch or two of plastic stands up along the walls of the tire. Now turn the top rim that has been cut off upside down. It fits like a lock on the bottom rim, holding the plastic firmly in place. Fill with growing medium,

(/resources/dbbef629-c872-4752-88b3-030741dd8fd7)usually starting with lightweight, airy materials on the bottom and soil or compost on the surface. If the plastic is trimmed to near the bottom of the tire, the garden will essentially be a portable "shallow bed garden." If the plastic is left so that a pool of water is formed, it will be more like the "shallow pool garden." (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch17ov.htm#Table)

OTHER BENEFITS OF ABOVE-GROUND GARDENING TECHNIQUES.

Protection from animals and floods. There are substantial areas along the Amazon in Brazil where all gardening is done in shallow beds on platforms. Local people have differing explanations for why this is done. This has an obvious advantage in flood-prone areas where even houses are sometimes built on stilts. But platform gardens are the primary gardening method even where it never floods. Wayne Smith reports that people in his area plant gardens on platforms to avoid damage by animals. "They make a platform of sticks, an old canoe etc. from 4-7 feet tall, place a layer of dirt and ashes/cinders on top, and then grow mainly green onions." (We have also heard that some farmers of Mayan descent in southern Mexico use the same technique.) Soils in some regions of the Amazon basin are highly acidic and contain so much aluminum that it is toxic to many vegetables. The improved growing medium that is concentrated on the platforms may give much better results in such situations.

Gardens for the handicapped. Shallow beds on platforms (that can be inexpensive because the gardens weigh so little) make gardening available to people with physical handicaps that prevent them from working in the soil. If platforms are placed at the right height, people in wheelchairs can garden easily.

Avoidance of soil diseases and pests. Root-knot nematodes are such a problem in our soils in Florida that susceptible plants cannot be grown unless the soil is sterilized. However, some fungi that live on decaying organic material kill nematodes. If we have enough organic matter in the soil we can sometimes get around the nematode problem. If we have 100% organic matter (as in a shallow bed and wick gardens) or no soil (as in the wick gardens), we have no root-knot nematodes. (After a few growing seasons, the decay process is essentially over. At this point the nematode-killing fungi may no longer be present and nematodes can again become a problem, unless the bed is renovated with fresh organic matter.)

Situations where there is a serious problem with the soil may lend themselves to above-ground gardening even in rural areas. One season we planted a few rows of green beans in the soil and, right beside them, a few more rows in a shallow bed garden. This bed was made of grass clippings just as though it were on a cement slab, except that it was in direct contact with the soil. Roots of beans from the grass clippings were totally nematode free; roots in the soil were covered with knots. Often at ECHO nematodes kill sugar snap peas before they bear, except when planted in a shallow bed of grass clippings on top of the soil.

Ability to garden in the shade of trees. Many heat-sensitive plants thrive better in some shade in the hot tropics. Above-ground techniques can be used to make beds on a sheet of plastic under trees. Tree roots are not damaged by tillage; the plastic prevents them from interfering with the vegetables; and many plants benefit from light shade. Tire gardens can be placed anywhere that provides enough light, even directly on protruding tree roots.
(https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch17ov.htm#Table)

LIMITING FACTORS IN ABOVE-GROUND GARDENING. It is not difficult to list possible problems with above-ground gardens. The poor may live in homes with rooftops that cannot even bear the weight of a person. Those with the most substantial rooftops may have the least incentive to garden on them. Fertilizers may not be available, especially those with micronutrients. People may not be prepared to give daily care to a garden. It may be difficult to develop a uniform formula for making the gardens when only recycled materials are considered. Water may be scarce and have to be purchased. Compost is usually not available unless people make their own, and motivation to do this may be lacking. Urban gardening projects in general have a reputation of little payoff among many in the development community.

There are situations where any of these problems may be critical. However, the world is a very, very large place. A creative perspective and innovative attitude is necessary to see successful above-ground projects develop. An idea that, if successful, promises to make acres of prime, presently unused, arable "land" suddenly available for producing food and some income, is deserving of special effort. We can begin with those thousands of situations where the above problems are not limiting--while we consider how to include more people.

It is imperative that your first community project succeed. Do not involve many people in above-ground gardening until you are sure you know what will work and have done it for at least one season. The success of the first community project is more important than saving on every possible ingredient. I think particularly of fertilizers. In every conversation it inevitably comes up, "Why not use manure tea instead of fertilizer?" It is possible, but it is not foolproof. (See discussion of this topic below under "Constructing the shallow bed.") It is almost certain that some gardeners will fail not because the methods themselves have a problem but because of inadequate concentration of nutrients in the manure tea. It is quite possibly cheaper (and certainly less offensive to the neighborhood) to use fertilizer than to haul in manure from the countryside. But more importantly, if it fails you will probably not get a second chance with the people who tried your "far out" idea of above-ground gardening.

Also, as with any new enterprise, *consider the market* before promising people that they can make money on their gardens. A Colombian organization developed a shallow bed/hydroponic system with many similarities to what we discuss in this chapter. The project used donated rubbish--rice bran from a mill and wooden crates from an auto parts shop--and recycled polythene from commercial flower farms. It cost families less than $5 to set up one square meter plot and under $9 per year to operate it, using commercial hydroponic fertilizer. In addition to what the 130 participating families used themselves, the cooperative sold over three tons of vegetables each month. A major supermarket chain bought produce from the community. Once a week produce was brought in, weighed, and paid for on the spot. From the sale of vegetables grown on the roof, the organization could pay the rent on their center. This enterprise was highly publicized, and apparently very successful for many years. ECHO was never able to make contact with the project directors. We heard that the project ended once the funding stopped, due to difficulty in obtaining the hydroponic nutrients. While it was operating, the key ingredient was that when each garden was planted, the market for its produce was guaranteed. It may be unrealistic for an informal group of gardeners to provide the quality control and regular supply required by a supermarket contract. Marketing is crucial, but to be sustainable it may need to be limited to individuals selling through established local channels. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch17ov.htm#Table)

WHERE ARE THESE ABOVE-GROUND METHODS BEING USED TODAY? There are examples of urban gardening and above-ground gardening to be found on some scale in most cities (see review (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch17ov.htm#Urba) of *Urban Agriculture* at the end of this chapter). There is a section on ECHO's home page for updates on above-ground gardening projects in process. Send us information on what you are doing so it can be included.

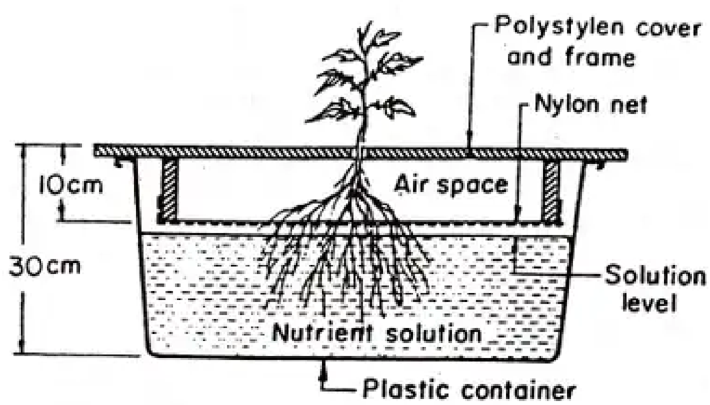
ECHO and several people in our network have been involved in projects for a (/resources/3cafed1c-12c1-4465-9dc2-06e1f3525ceb)number of years. A group called "Haiti Gardens" is very active in and around Port-au-Prince. ECHO staff member Dan Sonke visited some of those gardens in March 1996. We can send a copy of his trip report to interested visitors. They are using traditional methods on vacant land and also tire gardens both on rooftops and at ground level. The Christian Reformed World Relief Committee is in the beginning stages in 1996 of evaluating tire gardens for diverse settings in San Salvador, El Salvador.


A St. Petersburg gardener grows in recycled peat bags.

ECHO and the Center for Citizen Initiatives have together sponsored a rooftop gardening program in St. Petersburg, Russia. The combination of a population that loves gardening, a shortage of food, and an exceptionally high educational level makes this an ideal location. Nearly every citizen lives and works in buildings with huge flat cement rooftops. The main problem is in getting official permission to use the roofs. Institutions can more easily establish rooftop gardens than can individuals because the director of the institution that decides to establish the garden also controls the roof. There are now about 20 rooftop gardens in St. Petersburg. One garden on an apartment building has become a mini-farm, producing onions, herbs, and growing some container berry plants for resale. In 1995 a large garden was planted on the roof of the main prison in St. Petersburg. In 1996 a garden on an orphanage rooftop is beginning in Moscow. (https://cdn.ymaws.com/echocommunity.site-ym.com/resource/resmgr/a_to_z/azch17ov.htm#Table)

"WHAT ABOUT HYDROPONICS?" AND NON-RECIRCULATING HYDROPONICS. People often get excited about hydroponics for third world situations. I have never been among them. Hydroponic systems tend to be expensive, require energy and equipment for circulation of the water to get oxygen and nutrients to the roots, and demand close monitoring of nutrient concentrations. Its value is in situations where expense of production and price of product are very high, e.g. growing winter greenhouse tomatoes near a large northern city. The 3-or 4-fold yield increases from high-technology hydroponics may pay in such situations. I am unaware of many third world situations in that category, especially which would involve peasant farmers. Also, if a pump breaks down where parts are unavailable or the power goes off, the entire planting can be lost. Dr. Hideo Imai at the Asian Vegetable Research and Development Center in Taiwan sent us a description of a non-recirculating hydroponics system he developed (an abbreviated version was published in *HortScience*, vol 23, 906-907 (1988)). This system gets around these problems to a considerable degree. His discussion of air and water-nutrient roots is also helpful in understanding plant growth where there is at times a high water table. The following is abstracted from his reports.

Plant roots require oxygen, but I had not realized until Dr. Imai's paper that not all portions of a plant's roots require the same amount of oxygen. Plants can form what he calls oxygen (O) roots and water/nutrient (W/N) roots. Roots exposed to air specialize in taking up oxygen; those immersed in water specialize in taking up water and nutrients.



(/resources/da9b8366-562d-4717-9ffe-6fde36c737b4)This figure (from Dr. Imai) shows a schematic of a smaller adaptation of his non-recirculating hydroponic system. In the commercial unit, plants are suspended in holes cut in a lid that covers a 0.5 meter deep trough. The roots extend through the air, spread out onto a net, and then pass into water a few centimeters below the net. The purpose of the net is to provide support for extra O roots, which spread out over the screen. A smaller number of W/N roots drop on down into the water, but no further than 15 cm due to the limited amount of dissolved oxygen.

When the water level drops, the W/N roots change into O roots, a process taking only 2-4 days. However, this is not reversible. If solution is returned to the original depth the plants wilt within a few hours and do not recover. I can confirm this personally. When my interns left for the holidays it fell to me to maintain our first unit. I was surprised at how many gallons it took to get the water back to where I mistakenly **thought** it had been maintained. Water now covered roots that had been transformed into air roots. By the next evening the plants looked almost like they had been through a frost, and they did not recover.

ECHO did some interesting trials with the non-recirculating concept at the Caribbean Marine Research Center in the Bahamas. We thought the concept had potential for islands with only rock for soil. They had an unused commercial hydroponic unit in a greenhouse. We *disconnected* the pumps and grew very acceptable tomatoes, cucumbers and peppers with non-recirculating nutrient solution in each trough.

I am not recommending this system for most situations. After many trials we consider it too expensive, too heavy for a rooftop, a serious breeding ground for mosquitoes, and too temperamental for mass use. We did learn from it some important things about how plants grow, and it also influenced the development of the other systems we recommend. The shallow pool garden, for example, allows space for the O roots throughout the growing media and the W/N roots in the pool of water. However, the shallow pool is an improvement over the hydroponic system described above in that the depth of the pool, formed by placing sticks under the