

The Cornucopia Foundation



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A guide on building simple and low-cost hydroponic
systems (peat moss and plastic cups version)

July 10th, 2024

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Abstract

This version uses peat moss and plastic cups to keep the plant in place instead of pool noodles. Both versions work as well, however, we recommend doing the one for which it is the easiest to gather all materials depending on your location

A hydroponic system is a method of practicing agriculture that does not require soil. It is common knowledge that a plant needs water, nutrients, oxygen and light to thrive. As nutrients are usually present in the soil, hydroponic systems differ by using nutrients directly present in the water which does not require the use of soil. Benefits of hydroponic systems include:

- An increase in the rate of growth
- Reduction of risks related to soil-born diseases or natural catastrophes
- Being cost-efficient
- Less water used
- Less maintenance efforts
- Can be used anywhere
- Uses less space
- Possibility to grow crops which may not grow in certain regions
- Can be used for multiple growth cycles of the same plant

Inconvenients of using hydroponic systems can include:

- Difficulties to scale operations with a lack of financial resources
- Possible mistakes can happen on the setup
- Only one type of crops per recipient

There are multiple types of hydroponic systems that exist, some are used on an industrial level and are very complex and others are very simple and used for individual purposes.

The system shown in this guide follows a method called the Kratky method developed by Professor Kratky of the University of Hawaii. As seen in Appendix A and as explained in Professor Kratky article¹, the plants roots first barely touch the water where it gets its nutrients and water needs. It sits in a container that lets roots grow from it. Through time, the water level goes down from the plant using it, but its roots develop and follow the water keeping a constant input of water and nutrients. At the end of the growth cycle, the plant is harvested, and the process can be done again by getting rid of the remaining water, adding water halfway to keep an oxygen zone and putting nutrients back in.

Before building

As different types of plants of vegetables can be grown from hydroponics, it is important to note all of them have different requirements which will have a direct impact on their growth. Such requirements can relate to the quantity of water, the nutrient mixture, the size of the recipient, the amount of sunlight it needs and others. The system below was specifically designed for 10 plants of swiss chard and works best with green leafy vegetables. It is important to take this into consideration depending on the desired vegetable to plant. More information about requirements for every type of plants in a Kratky hydroponic system can be found here: <https://buckethydroponics.wordpress.com/>

This system also requires making the seeds germinate before building it. This video² is relevant for help on the germination process (refer to the beginning until 2:25min of the video): https://youtu.be/lilegSJlar4?si=5B4qmcQVK_GaRgL7. *Notes: peatmoss can be used, and 2 weeks suffice for germination. Refer to appendix E for a picture*

¹ Kratky, B. A., Dr. *Three Non-Circulating Hydroponic Methods for Growing Lettuce*. 2009, https://www.ctahr.hawaii.edu/hawaii/downloads/Three_Non-circulating_Hydroponic_Methods_for_Growing_lettuce.pdf. Accessed 2024.

² "Cultiver Un Potager Hydroponique à La Maison - Facile Pour Les Débutants." *YouTube*, DHD Garden, 18 Sept. 2022, youtu.be/lilegSJlar4?si=5B4qmcQVK_GaRgL7.

Building process

The first part of the building process consists of gathering the materials. A general list of materials needed for a Kratky system with any type of vegetables appears below. Specific requirements and materials used for swiss chard with pictures are available in the appendix and in the parentheses in the list. Guidelines for homemade mixtures of nutrients, pesticides and fungus treatment can usually easily be found on the internet or in store depending on your location.

- Opaque recipient that can contain water with lid ideally (EPS polyester boxes are cheap and work perfectly)
- Opaque cover that can cover the whole top of the recipient and does not dilute in water if lid is not included with the recipient (XPS polyester works perfectly, or EPS polyester can work)
- Something to keep the plant in place over the water which also prevents exterior liquid infiltration (plastic cups & peat moss or regular pool noodles work, for pool noodles one is enough)
- Liquid nutrients, nutrients that can dissolve in water or fertilizers for this version for the whole growth process (use nutrients with high amount of nitrogen)
- Pesticides
- Any type of fungus treatment
- A source of clean water
- Any tool to cut through the lid or cover of the recipient
- Some tape to maintain the cover/lid in place if needed
- Any tool to measure dimensions
- Adequate amount of vegetables you want to grow (10 swiss chard plants)

As mentioned, the precise materials with pictures for 10 plants of swiss chard are available in the appendix and will be used for this guide. It is also possible to change the quantity of vegetables grown if a smaller recipient is desired, all there is to do is change

the quantity of the materials. We can now process to the second part which consists of building the system in simple steps:

1. If a lid is not included and if the cover is not thick enough, stack multiple layers together

The cover needs to be strong enough to resist from crumbling with the weight of the plants. It also needs to prevent outside liquids, light or pests from entering. If needed, stack multiple layers together and make sure they are aligned well. There is no need to tape them together yet as this will be done in the next step.

2. If a lid does not come with the recipient, cut the cover to fit on top of the recipient

The cover needs to be able to stay on top of the recipient and cover the top completely. It is therefore better for the lid to be a bit bigger than being smaller and not cover the whole top. It is recommended to turn the recipient upside down on the cover and trace with a pen the outsides to make sure of the fit. If the cover consists of layers of layers as described in step 1, tape them together after cutting them.

3. Cut holes inside of the cover/lid to put the material that will keep the plant in place inside

The plants need to stay on top of the water for the tips of the roots to touch it without falling into it. Cut holes in the cover that are a bit smaller than the material used for it to stay in place. As plastic cups were used in that example,

cut holes that are a bit smaller than the size of the cup itself since you want the cup to stay in place and not fall in the recipient. For this system, cut 10 holes which are equally distanced, it is recommended to leave at least 15 cm of space between the center point of each cup. Pictures in appendix D can greatly help for the understanding of this part.

4. If plastic cups are used, cut holes on the bottom sides of the cover and the bottom to let the plants develop its roots from it if it has not already been done from the germinating process

Under the cup, you can do a “+” sign with the same thickness for the roots to grow. Do this for every plastic cup which will be used. Pictures in appendix D can greatly help for the understanding of this part.

5. Wash the inside of the recipients

It is important to wash the recipients since the water and the nutrients should not be contaminated by pollutants. Only water can be used but it is recommended to also wash with soap. Scrub if necessary.

6. Fill the recipient halfway with water and add the required amount of nutrients for the type of plant

For the required amount of nutrients, indications are on the label for premade mixtures. For homemade mixtures, follow the amount recommended from this guide or from the resources given at the beginning. Mix after putting the

nutrients, doing it with your hand is fine. For fertilizers, do not put them in the water, put it in the peat moss in the next step before putting the seeds.

7. Fill the plastic cups with peat moss and put your germinated seeds on top of the peat moss. Place the cups in the holes made in step 3

Make sure the peat moss has been mixed with water and that it is wet. It will solidify after, prevent it from falling through the holes and let the nutrient filled water to access the seed more easily.

8. Fill the bucket with water until the water is submerging the holes previously made in the cups

You do not want your plant to drown so it is important for the roots to touch the water but not entirely be under the water to get oxygen. You can place the cover/lid with the plants in it on top of the recipient to know the appropriate level.

9. If using a cover, tape one side to the recipient to make sure it stays in place

Tape only one side so you can open the system to see under the cover whenever needed. The cover needs to stay in place or else the roots might not reach the water and the system will be compromised.

Maintenance

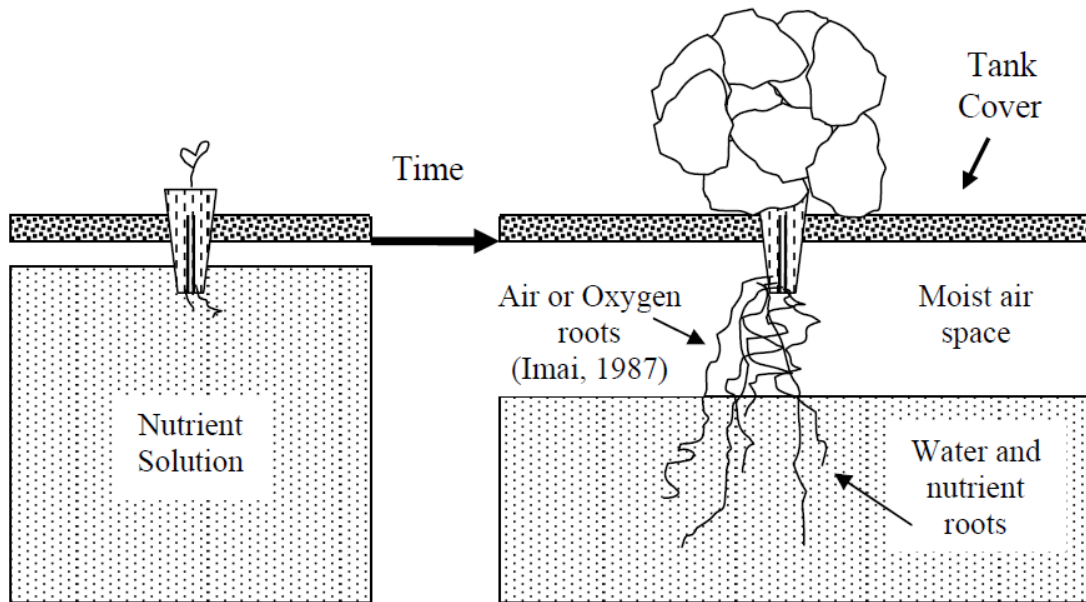
Throughout the growing process there are a few points to keep in mind even if the system can almost entirely run on itself. It is recommended every week to use pesticides and treat for fungus sicknesses. It is also recommended to check every day if the system is working well and act if treatment is necessary. Multiple signs of weakness can be shown by the vegetables. You can find below multiple signs of weakness swiss chard can show. More information is available on the internet or in the bibliography below.

- Yellowing leaves (lack of nitrogen)
- Bitten leaves (presence of pests, use pesticides)
- Plants falling and seem weak (lack of nutrients)
- Plant growing very slowly (look at pH, EC or lack of nutrients especially nitrogen)

Harvesting

When it is time to harvest your vegetables, it is important to not get rid of the whole plant. By only harvesting the outside leaves and keeping some in the middle, the plant will be able to continue growing for multiple cycles. To start again, the only step is to get rid of the water, fill it halfway with water and put nutrients again. It is important to leave half the space available for the oxygen roots to have enough oxygen. The same principle applies to any type of vegetables even if they are not leafy green vegetables.

Appendix



Appendix A – Demonstration of the Kratky method



Appendix B – Pictures of materials for swiss chard



Appendix C – Picture of the system for swiss chard after setup



Appendix D – Pictures of step 3 and 4



Appendix E - Germination

Bibliography

Kratky, B. A., Dr. *Three Non-Circulating Hydroponic Methods for Growing Lettuce*.

2009, https://www.ctahr.hawaii.edu/hawaii/downloads/Three_Non-circulating_Hydroponic_Methods_for_Growing_lettuce.pdf. Accessed 2024.

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