Completely Passive, Non-Recirculating Hydroponic Systems : Some Tips for Large Plants

On yesterday's post I talked about the existence of completely passive, non-recirculating hydroponic systems and how they can be successfully used for the growth of almost any hydroponic crop you can imagine. Following on this post's idea today I want to share with you some tips to use this type of system with larger plants so that you can effectively setup your own hydroponic passive farm with the least amount of effort and chance of failure. On today's post I will talk about the media and system characteristics for the raising of large plants, particularly plants like tomatoes, cucumbers and bell peppers which require large amounts of oxygen, nutrients and solid media support.
If you read the previous post you might remember that when using large plants -like the ones mentioned above – the best thing is to use a media filled container in which the nutrient solution is first close to the surface and then slowly gets used and evaporates from the nutrient solution. However it is also important here to say that there are some specific requirements for the media and some important changes that can be made to guarantee that success will be much more likely to happen.

The solid media used is better divided in two, the first media is a highly absorbent, capillary efficient media (like rice husk combined with sand 1:1) which is put in a small cup or container while the second media is a non-absorbent very capillary deficient media like gravel which is used to occupy the rest of the available space. Other coarse media can also be used to fill the rest of the container like vermiculite or other types of rocks. The important thing here is that the

whole media must NOT be efficient at capillary absorption because this will make the whole media wet all the time and it will drown the roots since the “air space” will be non-existent.

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You can follow the diagram above to build a system for a large plant. Note that the container for a large cucumber or tomato plant must be at least 5 gallons and solution needs to be added at a rate of about 1 gallon a month through the crops full life. Note that inserting a small PVC pipe to control volume within the container is always a good idea since you don’t want to put so much solution to drown the roots and make the plant die. Mature tomato plants require a space of at least 50cm of air roots when they are older for their proper development so make sure the container you use is about 70-100 cm tall when you build your system.

Hopefully with this advice you will be able to start your first passive large-plant hydroponic garden without using any electricity. Also remember that this setup requires absolutely no EC or pH adjustments since once added the solution won’t be able to be modified. This however does not cause any problems since the plants adapt to the solution and pH levels acquired. You can also increase the EC or change the nutrient ratios depending on the plant’s stage when you perform the monthly nutrient solution additions to your plant’s personal reservoir. Please feel free to leave any comments with your experiences with this technique !

Completely Passive, Non-Recirculating Hydroponic Systems : Yes, Its Possible

Generally when we think about growing plants hydroponically we think about complex setups with water pumps, air pumps, artificial lights, environmental control and greenhouses. However, it has been shown through many controlled experiments and experiences that hydroponics can be made in a much less fancy way, so simple in fact that pumps and other such appliances that consume electricity can be effectively and totally eliminated from the growing system without the need to lose a significant amount of crop quality or yield. On today's article I want to discuss some of these extremely simple setups and how you too can effectively and efficiently grow a hydroponic crop with low cost and absolutely no usage of electrical power.

Traditionally hydroponic systems – especially in developed countries – have been extremely dependent on electricity to make them work properly. Water pumps are used to carry fresh nutrient solution towards the plants and air pumps are used to keep the nutrient solution saturated with oxygen. However the truth is that such complicated setups are actually NOT necessary for successful hydroponic growth if adequate system design is actually made. People in less developed areas of the world such as South America, China and India have been experimenting with completely passive hydroponic setups to replace the more traditional energy intensive hydroponic growth and they have done tremendous progress to achieve this goal.

Many of you are probably already thinking about all the possible problems this might have. You might be thinking that this might work for small plants – like lettuce and some herbs – but never for nutrient hungry plants such as tomatoes, pumpkins, watermelons, etc. The fact is that these entirely passive non-recirculating systems work for ALL of these plants, providing adequate growing conditions and high yields

typical of hydroponic systems. Right now it is not a matter of opinion or discussion if it can be done as MANY studies and controlled experiments already show this is a reality. You can see some clear examples here, here and here.

The questions now becomes, how is this possible and how can you do it ? The answers are pretty simple. Passive hydroponics without any electricity can be done for large or small plants given that the following conditions are met :

- Enough space for roots is available
- Enough nutrient solution is available for all the crop's life (or it is replenished)
- Enough oxygen is available for the plant's roots

If this three conditions are met you will be able to build a passive hydroponic growing system that needs NO air or water pumps to give a good yield. How can you make such a system ? The systems that have given the best results up until now are those that follow a very simple design scheme. The plant is put in an absorbent nutrient media and placed to float or stand just above the initial nutrient solution level. The level of nutrient solution slowly falls down in the beginning (due to evaporation) and then quickly as the plants start to absorb water and nutrients. As the level of nutrient solution lowers the plant roots become exposed to layers of air from which they can absorb oxygen, allowing them to effectively absorb nutrients from the below stagnant solution without those roots dying.
Most people believe that if roots are submerged in an unaearated solution they will die but this is only true if the whole root system is submerged. If a good part of the system is given an "air buffer" from which to absorb oxygen and this space remains humid, the result is a system that can absorb nutrients from the unaerated solution and oxygen from the air buffer zone. This has in fact been shown to work in many cases (you can follow the links mentioned before for some examples).

For big plants such as cucumbers and tomatoes you would want to use a container filled with solid media to support the whole plant with the initial nutrient level being just a few inches below the surface while for smaller crops a “fixed top” idea might work much better. In the above image you can see both systems and how they evolve as the crops grow. For larger crops you might also want to replenish some solution every month so that the crops can get all the water and minerals they need if the actual container is not large enough to hold all the water the plant would use through its whole life cycle.

Without a doubt passive hydroponic systems like these ones will become extremely important in future world agriculture (especially in developing countries) since they are able to give us many of the wonderful advantages of hydroponics without the problem of complex electronic equipment, water, air pumps or an inherent dependency in the electric grid (which is not available everywhere in rural third world countries). Hopefully this information will also be useful for those looking to establish some passive and effortless hydroponic gardens to have fresh crops year round :o).

The Best Outdoor Hydroponic System. A Simple Way to Grow Large Amounts of Food

I have always seen that there is not a lot of information regarding outdoor hydroponics and the building of scalable and cheap systems that may provide large amounts of food without the complexity, trouble and expense of building a greenhouse. For the past several years I have been puzzled by this issue

and I have challenged myself to build an outside hydroponics system that is able to deal with environmental conditions successfuly, providing adequate conditions for plant growth without significant expenses and without the need for any protective enclosure. Finally, I came up with a system which – I believe – has a lot of promise for the above, giving us the opportunity to build an outdoor hydroponic system which has a low cost and a very high productivity potential. On today's post I will be talking about this system and how it can be easily built with less than 1K USD for each 100 square meters.
How do you build a scalable system that can be used on the outdoors with minimal problems due to uncontrolled environmental conditions ? The easiest thing I could think of was a simple continuous flow system which used the ground itself as a place to put the plants. This system uses no NFT channels, no large amounts of PVC pipes and absolutely no complex engineering. The system – shown on the drawing below – is simply a channel which is dug on the ground of about 2 meters wide by 25 cm deep. The nutrient reservoir can be a tank burried in the ground or a reservoir made from bricks and tiles out of another hole dug on the ground depending on the actual volume needs of the crop. The hydroponic system uses a PVC line connected to a pump to irrigate the system at the top and a small decline in the slope of the channel allows the solution to return to the tank through an underground pipe shown in dark blue. The channel is filled with a nutrient media that has adequate drainage and the nutrient solution is fed continuously through the irrigation system. Of course, when the channel is dug on the ground the soil has to be covered with a polyethylene sheet to prevent the solution to drain into the soil.

This system allows you to grow a wide variety of crops, from tomatoes to lettuce heads. The system can be used to grow plants of various sizes and nutritional needs since the media and continuous flow irrigation provides great oxygenation as well as a cheap alternative to more complex systems such as NFT or PVC pipe systems. The system is also absolutely

scalable, it can be built from a few square meters to a full plot size commercial cultivation facility without significantly changing the principle of operation. Since the surface area of the system is also large, and all nutrient solution is returned to a central reservoir, rain volume can be accurately determined and nutrients can be added or changed to make up for this effect of external environmental conditions.

The image shown below shows you how the system can be expanded to a full plot system without any modification of the fundamental working principle. The only things that need to be bought to start this system are a tank, a shovel, a polyethylene sheet as large as the channel requires, PVC pipes for the irrigation system and returns pipes, media, nutrients and seed. Since there is no greenhouse, no gutters, no polymer channels and no expensive irrigation equipment, the system is very simple and effective at growing plants at a large or small scale under outdoor conditions. It is also perfect for people who want to start a small hydroponic business and then expand it as they want to increase their production, since adding channels is easy and requires almost no changes (besides perhaps having larger pumps and increasing reservoir size once this is required).

In the end I believe that this system summarizes everything that I wanted to achieve with an outdoor hydroponic system. It is able to control and measure the effect and added volume of rain, allows the growth of a large variety of plants and provides us with a cheap and scalable solution to small and large scale commercial growing. Definitely there will be some problems that will probably have to be solved once larger applications start to develop but certainly I can say right now that this idea seems to be the largest, cheapest and most scalable solution for outdoor hydroponic growing available online :o).