Building a World Without Hunger : The Massive and Passive Hydroponic System Project

By Daniel Fernandez in Collaboration With the World

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1 Introduction

Thank you very much for downloading this document on the Massive and Passive Hydroponic System Project (MPHSP). The objective of the experiment you are about to participate in is to evaluate the potential and effectiveness of completely passive hydroponic systems under very varied world-wide conditions. The use of passive hydroponic systems is very important since they cut the cost of massive hydroponic production endeavors dramatically. Several scientific studies, have shown the great potential of this technique but the massive evaluation of its potential for different plants and varied climatic conditions remain elusive. The objective of this study will be to evaluate the potential of these systems under very varied conditions world-wide so that a correct assesment regarding the true possibilities of this technique to provide low-cost growth and a dramatic increase in agricultural yields in third world countries can be made. Your participation in the project may be of the scale and timing you choose to but a minimum area of 1 square meter (1m x 1m) and a time commitment of 2 months is the minimum participation requirement. Please read the requirements section to learn more about what conditions must be met in order to participate.

2 What This Project Will Tell Us

This project will help us learn many things about the massive use of passive hydroponic systems. These are some of the things we expect to learn :

- How easy it is to build and setup passive hydroponic systems under very varied conditions
- How easy it is to come up with the necessary salts and fertilizers to carry out this endevor in different countries
- How the yield under very varied conditions change when compared with the yield of greenhouse, controlled regular hydroponic crops
- If this alternative can potentially generate enough food to replace soil crops and reduce water usage in under-developed countries, even if conditions are very variable
- We will also learn about the effect of water quality around the world on crops
- If a massive effort and experimental jobs carried out by non-scientifically trained people can lead to the collection of usable data
- What different problems arise when passive systems are used under different conditions

3 Requirements

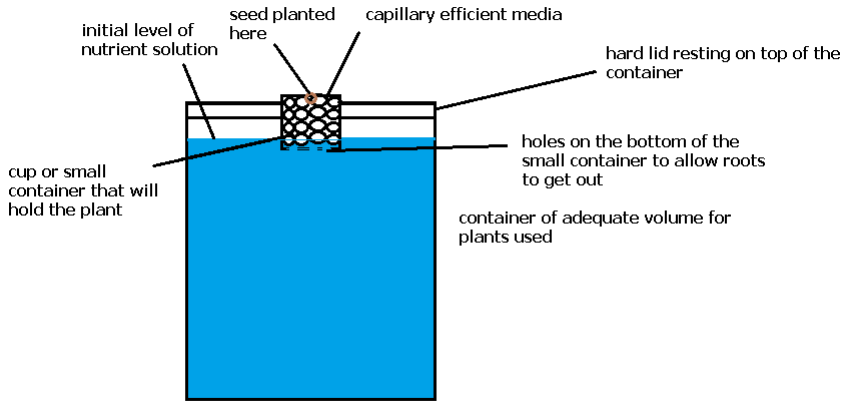
In order to participate on this project you need to fulfill a small set of requirements that guarantee that the data you provide will be of enough value to be considered useful. Please realize that since the objective is to provide results which can be used as guidance for third world countries and large scale ventures NO commercial hydroponic nutrient solutions must be used and each person must prepare their OWN according to the instructions provided. The minimum requirements are explained below :

- You need a camera with at least 5 MP resolution in order to take pictures of your setup
- You need to be able to take pictures at the same time of the day, at least 3 times each week
- You need to have an area of at least 1m x 1m available for the project (outdoors)
- A time commitment of at least 2 months must be made (in order to have a full cycle of the simplest crops, such as lettuce).
- A +/- 0.01g precision scale (these are cheaply available from eBay (<30 USD))
- The will to help and become involved :o)

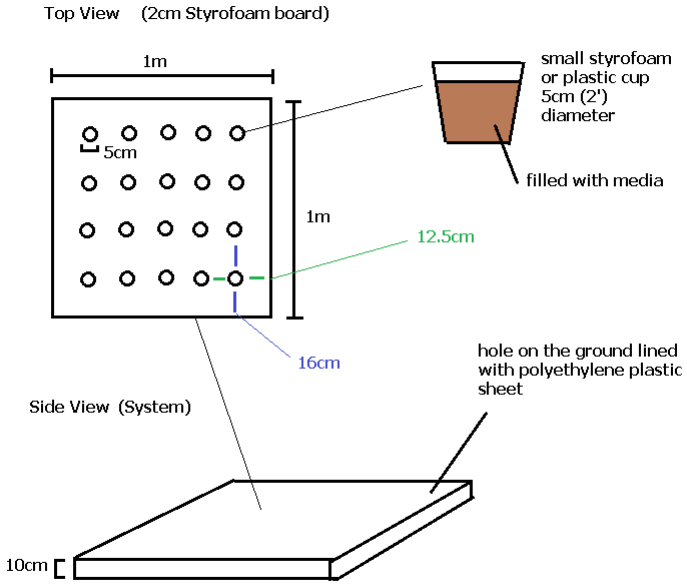
4 What you need to do

4.1 The Setup

The growing setup used for this hydroponic global experiment will use a very simple hydroponic system that will allow us to measure the growth, yield and success of a large variety of different crops. The setup will use absolutely no electricity and will only vary between different plants by the space available for their growth. The setup uses a container of a given size (depending on plant specie) with a hard cover in which a net-pot or other holding media (such as a plastic cup or small plastic bucket) is inserted. The small pot or cup is filled with a highly efficient capillary media which should be able to absorb water in the beginning stages of the crop. **Take into account that at least 5 plants need to be grown in order to have enough data to draw even the most basic conclusions**. The following picture depicts the system that we are going to use :



The media for the small cup can vary between different places (as different substrates might be available under different countries and settings), media like coarse sand, sand mixed with rice or coconut husk or highly absorbent expanded vermiculite or fine perlite can be used for this purpose. The volume of the container should be a minimum of one gallon for small plants (like lettuce) and at least 5 gallons for plants that are larger (either perennials or fruit bearing plants). The container should be made from plastic but the cover can be made from a variety of material depending on plant size, these include hard plastics, plywood or even Styrofoam for lighter plants (small herb shrubs and leafy vegetables). If the grower wants to grow large amounts of small plants -or even larger ones with a non-Styrofoam lid - the system shown below can be used. Or an adaptation of this system. Remember that as long as there are absolutely NO electrical appliances or pumps used the system design will remain valid. Also please remember NOT to use materials which are expensive in third world countries (such as PVC). Regular containers made from polyethylene, Styrofoam or other such materials are better solutions.



4.2 The nutrient solution

Perhaps the biggest challenge of this project is to come up with a nutrient solution that is reproducible amongst extremely different conditions and which can be used successfully by people in different countries. Instead of proposing a standard "recipe" for a given nutrient formula we are going to be using a set formulation which anybody can prepare using the salts available within their local resources by using the calculator available here : . Note that people can decide whether to prepare these solutions by direct additions or by the preparation of concentrated solutions. This does not matter as long as the actual weights and "final formulations" used are taken note of and the actual EC levels of the initial solutions are maintained. Note that given the fact that an EC meter might not always be available in third world settings people might use estimates obtained from the calculator's EC estimation as good approximations of how much concentrated solution they need to add to achieve a given value. The best thing however - if an EC meter is available - is to set the value when the solutions are prepared. **The formula used will be the formula loaded by default on the calculator.**

Note that for different plant species the initial EC levels will be adjusted fairly differently :

Plant	EC level (mS/cm)
Leafy Vegetables	0.8-0.9
Herbs and Grains	1.2-1.5
Fruiting Plants	1.5-2

There is no limitation to the plant you can grow as long as it is a useful and edible crop that is of interest to this project.

4.3 Growing Process and Maintenance

The idea of this system is to make it as independent and care-free as possible. For this reason there will be absolutely no adjustments of the EC or pH after the first EC value is adjusted. If the water is too hard, pH can also be adjusted as soon as the solution is prepared but no further adjustments might be done. After the system is setup and the seeds planted the system will remain self-sufficient for most purposes. These are some of the things that the grower must do every one or two days to verify that everything is working correctly :

- The seed must be planted within the cup as per the instructions of the particular plant desired. In order to maintain simplicity and eliminate transplants all plants should be sown directly on the system within the capillary efficient media cup.
- In the beginning the grower must ensure that the capillary media is kept moist so that the planted seed doesn't die. The media should take care of this by itself as it is being touched by the nutrient solution. If this doesn't happen the media should be changed for another more capillary efficient solution.
- The system should be filled with nutrient solution and the EC adjusted as shown above up to the point where it touches the lower part of the cup where the initial seed is contained.
- Check the solution level. If the container is almost empty near the end of the crop cycle you can add more solution but make sure that an air-buffer of at least 20cm is kept between top of the container and the nutrients.
- If the grower wants to carry out any pruning or training tactics on the plants he or she is absolutely free to do so. However the technique used must be described and any useful products (like tomatoes in a tomato plant) taken off the plant must be weight and recorded.

4.4 Data Collection

One of the most interesting aspects of this project is to see if some interpretations can be made from large amounts of different data sources under different growing and environmental conditions. Even though it is true that this data will be subject to massive variability and will not be conclusive on its own it will provide

a very good measurement of the average success achievable under very varied conditions. This project aims to measure the robustness of such a growing, passive, hydroponic approach, something for which this data is of tremendous usefulness. Every person only needs to provide a very limited set of data :

Growing conditions : data related to ambient temperature, location, hours of sunlight, water quality, final nutrient formulation and initial EC values should be used. If no official water quality information is available at least the initial EC value should be given. Also please mention if any corrections were done to the nutrient formulation to account for water quality issues.

Imagery : At least one picture should be taken once every 3 days to measure the progress of the project and tackle any problems that may arise quickly. This will give us a great idea of the significant problems people might run into and what this could mean to their productivity.

Weights : When the plants have matured, are fruiting or have ended their cycle it is important to carry some weight measurements to get an idea about the crop's outcome. Please weight the final product without roots (for leafy vegetables), all leaves (for herbs) and/or all collected fruits during the crops life (for fruiting crops) . The important thing is to weight the total production of the plant related to the part of it that is interesting to us as growers so if a plant is grown for fruit, all fruits need to be weight, the same for the leaves in herbs, etc.

All this information should be sent via email to dfernandezp@unal.edu.co contained within a zip file so that it can be evaluated and used successfully for this project. The information should be sent as a single package once the first crop has ended successfully.

5 Finally...

I would like to thank all of the people who want to participate in this project very much :o) This project will allow us to obtain a wealth of information about the use of hydroponics, the robustness of passive hydroponic setups and their possible use under less than ideal conditions. Once the project is finished (after a few years) the results will be published on an open journal where they will be accessible to anyone who wants to see them. Any advances we achieve in the meantime will be published in my blog at http://allhydroponics.blogspot.com Thanks again for all your help !