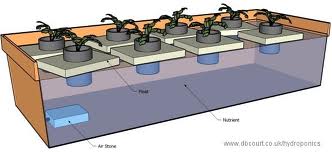
**The Feasibility Of Growing Plants/ Crops In A Hydroponic System**

**Hydroponics Vs. Soil Planting (using vegetables/ plants)**

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An Investigatory Project

Presented to the High School Department

Of Don Bosco Technical Institute

Of Makati City

In Partial Fulfillment of

The Requirements in

Science and Technology III

Submitted by: (2nd year - Namuncura)

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(**March 10, 2013**)

**ABSTRACT**

The destruction of habitats of most organisms is now one of the arising problems is this world.

Organisms such as plants have the capacity to serve as habitats that provide various significance of

the environment and specific organisms as well. Unfortunately, habitats not only in land but also in

water are at risk of destruction. Today’s rapid growth of human population causes the lack of

available space for crop agriculture. The traditional method for planting crops requires labor intensive

methods such as: tilling lands, watering the crops in a daily basis, using unhealthy pesticides,

fumigating the crops. Scientists say that “vertical farming” is the future plant agriculture although soil

is very hard to transport, especially in tall building. Hydroponics is done to have better control of the

nutrients being absorbed by the plants. A study was conducted during the past by us. We tested two

mongo plants, one in the hydroponic system and one in the pot of soil. We had observed that the

mongo plant grew larger and greener, the mongo plant in the hydroponic plant showed positive

results that supported our hypothesis that “plants grown in hydroponic systems would probably grow

healthier and larger compared to the soil planted plant. We concluded that growing plants in a

hydroponic system would help plants grow much healthier since the gardener/ cultivator would have

more control of the nutrients needed by the plant. For further results we would like to conduct a more

detailed experimentation and in a larger scale, only this time we would like to experiment on more

plants, plants like the: Cucumbers, Lettuce, Bell peppers, Radishes, Spinach

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**CHAPTER I**

**INTRODUCTION**

**Background of the Study**

Hydroponics is the method of growing plants in nutrient-enriched water instead of soil, producing a healthier plant and healthier aromas. Plants grown using this method produce fruits and flowers with clearer, purer, more transparent scents. Impurities from soil and bacteria are eliminated, allowing hydroponically grown flowers to be used in the creation of fragrances for all scent applications.

Since most plants can be grown hydroponically, it can be used by farmers and gardeners all over the world. There really isn't any such thing as a "hydroponic plant".

We will conduct an experiment about “hydroponics”, we would test whether if it is worth it to replace soil planting methods with hydroponic systems.

**Statement of the Problem**

1. How will the growth of crops be affected in changing the fertilizer ratio (Nitrogen: Phosphorus: Potassium)

a. 30-10-30 b. 5-10-5

c. 20-10-30 d. 1-2-1

2. How can the planting method affect the plants growth (exposed to same concentrations of fertilizer/ nutrients) :

a. Height? d. Taste?

b. Number of leaves? e. Stem’s Diameter?

c. Color?

3. Will the selected plants grow in hydroponics medium?  
4. Which of plant varieties grow best in the hydroponics medium?  
5. What are the factors that will affect the growth of sweet potato in the hydroponics medium?

Hypothesis of the Study

We think that the plants will grow much healthier in the hydroponic setup since we would have more control on the variables that affects the plant’s growth, like the: flow of water, nutrient circulation, scheduled watering and etc.

**Significance of the Study**

If the hydroponic system wins, the future of plant agriculture could change dramatically. In the future, we could find hydroponic systems on the rooftop of buildings and skyscrapers. It would be easier to plant crops on highly dense urban areas. Now, “vertical farming” would be a lot easier to perform. It gives both economic and aesthetic value. For the aesthetic value, it gives us the whole view of the plant from its roots to its stems, leaves, and even flowers. For the economic value, leaves of the said root crops can be harvested for food and medicinal purposes, since plants planted in hydroponics systems are proven to be more sterile since it is in a controlled environment.

**Scope and Limitation of the Study**

In large scales, hydroponics has a high starting cost but as time passes by, the farmer/ gardener will eventually get the money back. It is not easy to operate hydroponic systems especially for people who have no background knowledge in hydroponics. We also do not know whether the electric consumption during night (using a AC adaptor) would be costly, that is why we are going to integrate the subject of “ET/ ELX” with our IP experiment by calculating the price cost and adding a complex motor control circuit for the water pump (controls, motor speed, scheduled watering – timer)

**Definition of Terms:**

**Hydroponics**- is a method of growing plants using mineral nutrient solutions instead of soil.  
**Motor Control Circuit** – Used to control the motor pump’s speed and timing.

**ET/ ELX** – Acronym that stands for Electronics / Electrical. It is a technical subject in Don Bosco Makati

**Nitrogen** - Compound that is added to plants or lawns to stimulate growth.

\_\_\_\_\_\_\_\_The nitrogen stimulates chloroplasts in plants, which are responsible for the process of \_\_\_\_\_\_\_\_photosynthesis. Plants that do not have enough nitrogen will turn yellow and eventually \_\_\_\_\_\_\_\_perish from a lack of food.

**Phosphorus** -  isused by plant to increase fruit development and to produce a strong root system.

**Potassium** - is used by plants for flower color and size. It is also important to the strength of the plant.

**CHAPTER II**

**Review of Related Literature**

Hydroponics is a method of growing  
plants using mineral nutrient solutions instead of soil. Hydroponics also basically means working water ("hydro" means "water" and "ponos" means "labor").  
Hydroponics offers many advantages for commercial agriculture. Cultivating plants without soil eliminates the need for vast farmland and allows crops to be produced in greenhouses or even in the desert sands. Hydroponic techniques also allow for precise water and nutrient application directly to the roots of each plant.  
Root crops are plant root usually found underground for food storage. In the global food system, it is envisioned that root crops will emerge in the form of diversified range of high-quality and competitive products for food, feed and industry. Root crops play a very important role in food security and poverty eradication in the Philippines. They are readily available health crops, which can be utilized for food, feeds, and other industrial uses.  
Root vegetables are plant roots used as vegetables. Of particular economic importance are those with a high carbohydrate concentration in the form of starch. One of these starchy root vegetables is the so-called sweet potatoes, scientifically named Ipomoea batatas which can be used to grow in hydroponics. Sweet potatoes are crop plants with large, starchy, sweet tasting tuberous roots.  
Some of the varieties of the sweet potatoes are the Garnet, Beauregard, and Jersey. Garnet varieties are deep red or purple-skinned and their flesh is soft and moist orange. Beauregard ones are light-copper-skinned and have crispy, moist bright orange flesh while the Jersey ones are creamy-yellow or tan in color and have pale yellow and “dry” flesh.

http://my-research-proposal-biotech-07-08.blogspot.com/2008/02/feasibility-of-growing-sweet-potato-in.html (Name:N/A)

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According to this website, they suggest Swedish Ivy /Creeping Charlie. They say that this plant seems to grow no matter what – they even rooted this one in a coconut pound cake ! The roots will set from the nodes. Put the cuttings in a glass of water and wait for roots to appear (aprox 2-3 weeks).   
  
But we decided to use monggo seeds instead of Swedish Ivy. We chose monggo because it is affordable and it is very common to us.   
  
They suggest that we should use: empty 2 liter soda bottle, wick, fertilizer, plant, lemon or lemon juice, baking soda. Optional: pH test kit or litmus paper, straw, Lego blocks, shredded fabric, shredded paper. But we instead used a container and a funnel (see making the machine).   
  
Hydroponics is the act of growing and supporting plant growth and nutrition solely through water instead of soil. Hydroponics is very helpful to farmers because it allows them to grow larger quantities of plants in smaller areas. It also allows people in areas with poor soil the ability to still grow plants, simply by creating a controlled hydroponics growing tank.  
Children usually can get really excited and interested in the life cycle of a seed when the general information is presented to them. Hydroponics is probably the easiest, most hands-on strategy you can share with them. The children can be in charge of all or nearly all of the duties necessary to support the hydroponics tank, which will get them invested in this project, and in turn, will help them learn more effectively.  
First, you must gather the appropriate supplies for creating your hydroponics tank. You will need: a gallon sized container with dark sides to prevent light from damaging the roots, several empty egg cartons, liquid hydroponic nutrient, bleach, several bush bean seed packets, small containers with lids to sprout the seedlings, and coffee filters. Later, as the plants begin to grow, you will need to purchase string and straws for support.  
To sprout the seedlings, place 5-10 seeds inside a coffee filter and place them inside the smaller containers. Fill the container with water, allow the seeds to soak for 10 minutes, then drain and replace the lid tightly. Soak the seeds like this every day until roots and stems begin to grow long enough to place into the hydroponics tank. This will take 7-10 days. If you notice mold beginning to form, add 1 tsp of bleach to 1 gallon of water, and rinse the seeds with that mixture until the mold dissipates.  
Prepare the hydroponics tank by filling the large gallon tank with water a few days prior to transferring the seedlings so the water has time to shift to room temperature. Mix the appropriate amount of nutrient solution in with the water. Cut small holes in the bottoms of the egg cartons where each egg would have been. When the seedlings have 2-3 inch roots, place their roots gently inside the holes of the egg carton. Place the egg cartons into the nutrient water tank, root side down.  
Place the tank in a brightly lit area. Have the children measure the seedling growth every day and keep a chart of their growth. As the seedlings sprout higher, attach straws to the sides of the tank with tape, and gently attach the stem of the plant to the straw with string. This will help support the stems so they do not break. In 4-6 weeks' time, beans will begin to sprout. When the beans reach 5-6 inches in length and a deep green color, they may be picked and eaten.  
  
Article Source: <http://EzineArticles.com/4114108> (By. TOFER TANG)

The destruction of habitats of most organisms is now one of the arising problems is world is now coping with. Organisms such as plants have the capacity to serve as habitats that provide various significance of the environment and specific organisms as well. Unfortunately, habitats not only in land but also in water are at risk of destruction.

One of this Rhizophora mangle commonly called as mangroves. Mangroves provide us so many benefits including the protection of coastal areas from erosion, storm surge and especially during tsunamis. This condition of Rhizopora mangle arose the researchers to think of alternate ways that can help increase the population of Rhizopora mangle. And one of these is Hydroponic Gardening. Hydroponic gardening is the process of growing plants in water mixing with mineral nutrients without the use of the soil. In addition, the salinity of water. But as evolution occurs, the salinity level of the water in which the mangroves grow increases the saline level of water making it highly acidic that can badly affect the growth of Rhizophora mangle.

The study had been centered on the efficacy of Hydroponic gardening and the Salinity of water in the Height attainment of Rhizopora mangle in confined tanks. The study was conducted at Room 2, ESEP Bldg. of Tarlac National High School. To make the study possible, the researchers had undergone series of experimentation and observations of the mangroves adaptability on Treatment A wherein the plant subjects were treatment with hydroponic solution and subjected to Freshwater. Meanwhile, Treatment B whose plant subjects were in Saltwater with both 2 replicates each. The data gathered showed that Rhizophora mangle subjected to Freshwater showed a positive result on their adaptive mechanism in terms of their height attainment. Thus, the salinity of water is one of the factors that affect the height attainment of this species.

Results showed that raising Rhizophora mangle in Freshwater with Hydroponic solution is better than in Saltwater without hydroponic solution. It showed that the mean average attained height of plants in Treatment A has a mean of 64.23 cm while in treatment B the average attained height of plants subjected was 52.35 cm

Rocellyn Allysa N. Gonzales

Cammile Apple M. Albania

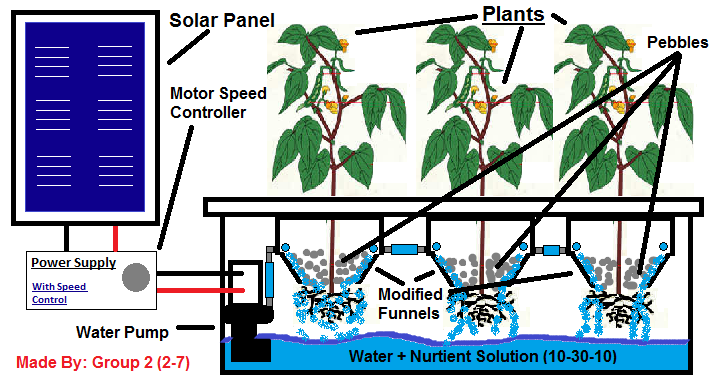
Joshua V. Tan

http://region3.dost.gov.ph/index.php?option=com\_content&view=article&id=395%3Aa-hydroponic-solution-test-on-the-height-attainment-of-rhizophora-mangles-in-confined-tanks-through-its-evolutionary-pathway-to-freshwater-&catid=20%3Aengineering&Itemid=45

**CHAPTER III**

**METHODOLOGY**

**Experimental Design**



The system pumps a mixed nutrient solution in the water. In addition, we powered the system with solar energy during day and battery during night.

**Material/ Instrumentaion**

|  |  |  |
| --- | --- | --- |
| * Water Pump | * Rectangular Pot | * Sponge/ Aquarium Filter |
| * Vinyl Tubes | * Funnels | * Fertilizer (14-14-14) |
| * Solar Panels/ Batteries | * AquariumTube Connectors | * Glue Gun |
| * Switches | * Pebbles | * Regular Pot (with soil) |
| * Okra Sprouts | * Mongo Sprouts | * Lettuce Vegetable |

**Sampling Procedure**

**1st Setup (soil planting):** For the first setup, we have planted three different seedlings in three different pots, the mongo, okra and lettuce. All three of them will receive the same amount of sunlight, water and fertilizer. The experiment will last for 1 month. The first setup will be our “regular soil planting method”.

**2st Setup (hydroponics):** For the second setup, we constructed our own hydroponic setup from scratch . The water pump of the hydroponic system will be powered by a 3 watt solar panel during day and an AC adapter during night. The suggested fertilizer-water mixture is “4 tbsp: 1 liter” we will be using a 14-14-14 fertilizer.

There are 6 different hydroponic systems, we chose the “drip system design” since it is easy to construct, cheap, choice of farmers and materials can be easily found in local electronic and hardware stores.

Same thing will apply; we planted three different sprouts on three hydroponic pots, the mongo, okra and lettuce. The experiment would last for one month together with the “soil planted plants”.

**Research Procedure**

The set-ups were placed inside a room/box for one week. This was to allow root formation on the different set-ups made. After one week, the set-ups were then exposed to sunlight.  
The root formations per set-up were observed daily for one week period. Then when the set-ups were exposed to sunlight, daily observation was done for one week also. Then the succeeding observations were done weekly.  
  
Water in the containers were replaced every week. There were also varied set-ups made to confirm the results of the study. The other set-ups used were empty plastic coke container (1.5 liter), plastic cups, and microwave oven plastic containers.

**http://my-research-proposal-biotech-07-08.blogspot.com/2008/02/feasibility-of-growing-sweet-potato-in.html** (Name: N/A)

**Flowchart**

**Price Canvas & Blueprint Designing**

**↓**  
**Preparing the Materials  
↓**

**Building The Hydroponic System**

**↓  
Finding Two Plants with similar measurement**

**(ex. height, condition, color)  
↓  
Setting Up Plant A = Soil Setup**

**Setting Up Plant A = Hydroponic Setup  
↓  
Observation and Analysis**

**EXPERIMENTATION: MAKING THE MACHINE (MONOPOT - HYDROPONIC SYSTEM)**

|  |  |  |
| --- | --- | --- |
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| C:\Users\Angelo\Desktop\Hphonics\IMG_1566.JPG | C:\Users\Angelo\Desktop\Hphonics\IMG_1570.JPG | C:\Users\Angelo\Desktop\Hphonics\IMG_1572.JPG |
| C:\Users\Angelo\Desktop\Hphonics\IMG_1580.JPG | C:\Users\Angelo\Desktop\Hphonics\IMG_1575.JPG | C:\Users\Angelo\Desktop\Hphonics\IMG_1578.JPG |
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|  |  |  |

**CHAPTER IV**

**RESULTS AND DISCUSSIONS**

**Data Analysis**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **WEEK#1** | **WEEK#2** | **WEEK#3** |
| Soil Potted Plant  (Kalachuchi Plumeria) | **Height = 149mm**  **Leaves = 16**  **Leaf Color = Green** | **Height = 154mm**  **Leaves = 24**  **Leaf Color = Green** | **Height = 169mm**  **Leaves = 29**  **Leaf Color = Green** |
| Hydroponic Pot Plant  (Kalachuchi Plumeria) | **Height = 148mm**  **Leaves = 13**  **Leaf Color = Green** | **Height = 163mm**  **Leaves = 23**  **Leaf Color = Green** | **Height = 185mm**  **Leaves = 33**  **Leaf Color = Green** |

**Graph: (Green = Hydroponic, Red = Soil) (Violet = Hydroponic, Blue = Soil)**

|  |  |
| --- | --- |
|  |  |

**Interpretation**

After graphing the results, we found out that the slope of the hydroponic plant's growth is more aggressive in height and leaf number increase. This means plants drawn in a hydroponics system will most likely grow faster compared to the soil planted.

**CHAPTER V**

**CONCLUSION AND RECOMMENDATIONS**

**Conclusion**

Based on the upon the data that we had gathered, hydroponic planting produces more leaflets and leaves, making it more productive for raising plant life at a faster time scale, this would help the agricultural industry to produce more crops and to be sold and supplied to marketable consumers. By the aid of a " smart solar powered battery bank" no electricity was consumed coming from the outlet during the process, this would also result to less human labor in plowing, watering and maintaining the plants.

**Recommendations**

It's better to run hydroponic systems by using solar energy during day and batter power during night (partially charged during day), this would result to a sustainable power supply, by doing this your electricity bill charged for the system will be reduced to zero pesos. Choose the proper fertilizer mix, too much will wilt your plant and too few will make your plant grow slower, fertilizer is a huge factor in hydroponic planting.

(Viva Green Renewable Sources! The future is coming)

**APPENDICES** (Experimentation)

|  |  |  |  |
| --- | --- | --- | --- |
| **WEEK#** | **WEEK#1** | **WEEK#2** | **WEEK#3** |
| Soil Potted Plant  (Kalachuchi Plumeria)  **Plant A** | **C:\Users\Angelo\Desktop\ap\IMG_1606.JPG**  **Height = 149mm Leaves = 16** | **C:\Users\Angelo\Desktop\ap\IMG_1602.JPG**  **Height = 154mm Leaves = 24** | **C:\Users\Angelo\Desktop\ap\IMG_1601.JPG**  **Height = 169mm Leaves = 29** |
| Hydroponic Pot Plant  (Kalachuchi Plumeria)  **Plant B** | C:\Users\Angelo\Desktop\ap\IMG_1598.JPG  **Height = 148mm Leaves = 13** | C:\Users\Angelo\Desktop\ap\IMG_1596.JPG  **Height = 163mm Leaves = 23** | C:\Users\Angelo\Desktop\ap\IMG_1594.JPG  **Height = 185mm Leaves = 33** |