Nutrients Required For Hydroponic System

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***ABSTRACT*: Hydroponics was found to be better alternative and can be defined as the cultivation of plants without soil, which is being commercially used in the most of the western countries. This study explores the applications of this cultivation technique and to reveal its future importance. This technique can be adapted to almost all the terrestrial plants. Vegetable food crops like wheat, tomato, marijuana, dill and many more plants are being cultivated in commercial scale. The construction of a hydroponic system requires an initial investment, hard work, and care. Better the yield will be, if approached as it needs. It was recommended that this technique can be adapted as a step to produce the food crops and medicinal plants to meet the global demand, to control the global warming, and there by conserving the Mother Nature for the better future. The increased population, sub-urbanization of the forest (excluding land for commercial food production), improper agricultural practice which altered the soil pH, synthetic fertilizers, pesticides which drastically reduced the soil flora and fertility which made a quench for the new alternative technique for obtaining the food and medicinal plants of better quality, yield and for growing fresh produce in non-arable areas of the world. Consumption of herbal medicines is widespread and increasing. Harvesting from the wild, the main source of raw material is causing loss of genetic diversity and habitat destruction.**

***KEYWORDS*: Hydroponics, Terrestrial plants, Mother Nature, Nutrients, Types of Crops By Hydroponic System**

INTRODUCTION:

The use of controlled environments can overcome cultivation difficulties and could be a means to manipulate phenotypic variation in bioactive compounds. When it comes to being environment friendly, hydroponics is beneficial over geoponics, mainly because these methods do not promote the use of chemicals fertilizers or pesticides. NASA have a list of 15 plants, grown using hydroponics that will save our life (should the need ever arise). One reason behind the drive to develop hydroponics was the need for growing fresh produce in non-arable areas of the world. Consumption of herbal medicines is widespread and increasing. Harvesting from the wild, the main source of raw material, is causing loss of genetic diversity and habitat destruction. Domestic cultivation is a viable alternative and offers the opportunity to overcome the problems that are inherent in herbal extracts, misidentification, genetic and phenotypic variability, extract variability and instability, toxic components and contaminants.

ADVANTAGES OF HYDROPONICS GARDENING

1. Hydroponics gardening can be packed and kept it alive and fresh for longer periods of time.
2. Hydroponics gardening doesn't even use any kind of solid medium.
3. Full control of the plant's root system and in eye contact always.
4. No need to worry about over watering or under watering.
5. It can be developed in areas where there's Geoponics gardening should always be no quality soil present. E.g. In areas covered with snow or in a space station.
6. An excellent plant research and plant learning tool and can be transferred anywhere without any hassle.
7. In hydroponics gardening there is no soil at all no weeds and no pesticides of course.
8. The use of water to maintain and preserve the plant can be dramatically reduced.
9. A hydroponics garden may be set up with timer systems to automatically fertilize the plants.
10. Healthier because they receive a balanced and controllable portion of nutrients.
11. Stable, safe and high yields.

The extension of the growing season is not the only advantage contributing to the growing popularity of hydroponics production with both growers and consumers. There are several additional advantages as well including nutritious, healthy and clean produce, improved and consistent vegetable quality and elimination of the use of pesticides and herbicides. Pesticides and other chemicals used in conventional agriculture have an adverse environmental impact; the runoff from these chemicals, contaminates groundwater supplies. Commercial hydroponics systems eliminate these toxic chemicals and contribute substantially to keeping the groundwater free from contamination.

PLANTS GROWN HYDROPONICALLY:

It is practically possible to grow any types of fruit, vegetable, herb etc. using this technique. Hiercium pilosella, Hypericum perporatum, Arnica montana, Ocimum basilium (basil), Anethum gravel (dill), Chrysanthemum partherium, Aloe vera, Mentha spp.(mint), Rumex officinalis (French. sorrel), Rosemary officinalis (rosemary), St.john's wort, cucumber, spinach, chili, lettuce,

broccoli, pepper, petunias, tomatoes, cabbage, green peas, echinacea, ginseng, thyme, tarragon, spearmint, peppermint, sorrel, sage, oregano, marjoram, mache, leman baln, coriander, chives, chervil, aurugula, potatoes, and many other are the popular choice of vegetables that can be grown using hydroponics. Similarly, fruits such as strawberries, watermelons and cantaloupes can also be grown using hydroponic gardening at home. Flowers show a better bloom when grown hydroponically. Growing plants hydroponically is not only easy but also effective in terms of end product. The entire hydroponic system can be made automated, so that it can be even controlled from another country. Mostly basic systems are preferred. Hydroponics allows us to grow vegetables and fruits inside our apartment.

Nutrient solution*:*
Most herbs grow well with a basic nutrient solution. Many readymade choices are available. Care must be taken to avoid minor nutrient deficiencies. Several different herbs may be grown in a single nutrient solution.

Elements	N	P	K	Ca	Mg	Mn	Fe	Cu	B	Zn	Ma
Ppm	210	70	300	180	67	1.25	3.0	0.26	0.5	0.40	0.06

The E.C. (electrical conductivity) of this formula should be approximately 2.5 and the pH adjusted to 5.5 - 6.5. If the day length is below 11 hours, the E.C. should be increased to 3.0- 3.6, but the concentration of nitrogen kept at 210 ppm. Under these conditions, a smaller root system develops and more energy is available for shoot (vegetative) growth. The higher E.C. ensures adequate nutrition even with a smaller root system. Following seeding or root cuttings, the first watering should be with a half-strength nutrient solution, pH 5.8; however, the phosphorous concentration should be maintained at 80 ppm. Following germination, or after the first root initiate on the cuttings, the full strength nutrient solution should be used.

Temperature
Temperature affects plant in two ways. High temperatures tend to accelerate the growth of the plant which increases the plant need for water. High temperatures also increase the plants consumption of water for cooling itself through evaporation.
Air
Wind or air movement has a dramatic influence on the plants consumption of water particularly when combined with high temperature in much the same way as clothes dry much faster on our clothes line on a windy day. In some plants it helps in pollination.
Shelter and support
Shelter for hydroponic gardening depends upon the type of cultivation to be carried out. The cultivation of the vegetables for the household gardening backyard waste land or the terrace is sufficient. The commercial production of the food crops and the medicinal plants requires the large area. Supporting arrangements can be made depending on the type of plant grown which may help in the increased yield.
List Of Crops That Can Be Grown In Soil-Less

Condition

Everything starting from flower to fruit crops to medicinal plants can be grown using soil-less culture. List of crops are listed in Table 1, Table 2, Table 3.

Type of crops	**Name of the crops**
Cereals	Oryza sativa (Rice), Zea mays (Maize)
Fruits	Fragaria ananassa (Strawberry)
Vegetables	Lycopersicon esculentum (Tomato), Capsicum frutescens (Chilli), Solanum melongena (Brinjal), Phaseolus vulgaris (Green bean), Beta vulgaris (Beet), Psophocarpus tetragonolobus (Winged bean), Capsicum annum (Bell pepper), Brassica oleracea var. capitata (Cabbage), Brassica oleracea var. botrytis (Cauliflower), Cucumis sativus (Cucumbers), Cucumis melo (Melons), Raphanus sativus (Radish), Allium cepa (Onion)
Leafy vegetables	Lactuca sativa (Lettuce), Ipomoea aquatica (Kang Kong)

Condiments	Petroselinum crispum (Parsley), Mentha spicata (Mint), Ocimum basilicum (Sweet basil), Origanum vulgare (Oregano)
Flower / Ornamental crops	Tagetes patula (Marigold), Rosa berberifolia (Roses), Dianthus caryophyllus (Carnations), Chrysanthemum indicum (Chrysanthemum)
Medicinal crops	Aloe vera (Indian Aloe), Solenostemon scutellarioides (Coleus)
Fodder crops	Sorghum bicolor (Sorghum), Medicago sativa (Alphalfa), Hordeum vulgare (Barley), Cynodon dactylon (Bermuda grass), Axonopus compressus (Carpet grass)

Table -1**.** List of crops that can be grown on commercial level using soil-less culture

Name of crop	**Hydroponic equivalent per acre**	**Agricultural average per acre**
Wheat	5,000 lb.	600 lb.
Oats	3,000 lb.	850 lb.
Rice	12,000 lb.	750-900 lb.
Maize	8,000 lb.	1,500 lb.
Soybean	1,500 lb.	600 lb.
Potato	70 tons	8 tons lb.
Beet root	20,000 lb.	9,000 lb.
Cabbage	18,000 lb.	13,000 lb.
Peas	14,000 lb.	2,000 lb.
Tomato	180 tonnes	5-10 tonnes
Cauliflower	30,000 lb.	10-15,000 lb.
French bean	42,000 lb. of pods for eating	-
Lettuce	21,000 lb.	9,000 lb.
Lady_s finger	19,000 lb.	5-8,000 lb.
Cucumber	28,000 lb.	7,000 lb.

Table-2**:** Hydroponic averages compared with ordinary soil.

Vegetables	**Production (g/m2/day)**
Carrot	56.5
Cucumber	226
Garlic	57
Ginger	57
Leek	57
Green Bean	113
Lettuce	226
Onion	56.5
Peapod	113
Potato	56.5
Salad greens	226
Tomato	113
Greens	113

Table -3 :Vegetable production under soil-less culture in India

Application of pesticides is generally avoided under hydroponics system. With reduced pest problems and constant feeding of nutrients to the roots, productivity in hydroponics is high, despite limited plant growth by the low levels of carbon-di-oxide in the

atmosphere, or limited light. To increase yield further, some sealed greenhouses inject carbon-di-oxide into their environment to help growth (CO2 enrichment), or add lights to lengthen the day, control vegetative growth etc.

SUPPLY OF NUTRIENTS TO THE PLANTS

In hydroponics, because of limited nutrient-buffering capacity of the system and the ability to make rapid changes, careful monitoring of the system in necessary. Two aspects ofnutrition need to be considered: the supply of nutrients from the nutrient delivery system and the plant nutrient response. For most common crop plants critical levels for most nutrients have been determined. Sources of nutrient elements with their characteristics are given in table 4.

Sources of nutrient elements:

Source	Element	Characteristics
Potassium nitrate KNO3	N, K	Very soluble salt
Potassium phosphate monobasic KH2PO4	P, K	Corrects phosphorus deficiency
Magnesium sulfate MgSO4	S, Mg	Cheap, highly soluble, pure salt
Iron chelate	Fe Cit	Best sources of iron
Boric acid H3BO3	B	Best source of boron
Calcium nitrate Ca(NO3)2	N, Ca	Very soluble salt

Table -4: Sources of nutrient elements with their characteristics

The frequency and volume of the nutrient solution applied depends on the type of substrate used (volume and physical-chemical characteristics), the crop (species and stage of development), the size of the container, the crop and irrigation systems used and the prevailing climatic conditions. Plants should be fed daily. The best time to administer the nutrient solution is between 6.00 and 8.00 am, though water requirements will vary considerably throughout the day, and from one day to another. The solution should be applied to the roots, trying to avoid wetting the leaves to prevent damage and the appearance of diseases. Under no circumstances should plants be allowed to suffer from water stress, as this will affect their final yield. It is generally recommended that you apply only water to the plants once a week, in order to flush away any excess salts that have remained. Use double the amount of water normally applied, but without adding nutrients. Between 20 and 50% of the solution should be drained-off to prevent the accumulation of toxic ions and an excessive increase of electrical conductivity in the root area. The excess nutrient solution that is drained away from containers during daily watering can be reused in the next watering.

CONCLUSION:

-There is a high demand for medicinal and aromatic herbs.

- Harvesting from the spontaneus flora is dangerous for the biodiversity.

- Intensive cultures and traditional agricultre is difficult in actual context.

- Soilless cultures and protected environment facilities cand be implemented everywhere and are not dependent on climatic factors.

- Hydroponic cultures represent the most intensive method of cultivation.

- Hydroponic cultures have higher yields than traditional agriculture.

-There is an ascendent trend in popularity and implementation of hydroponic cultures worldwide.

- Substrated used in hydroponic systems are steril, neutral and have a high capability of holding moist and nutrient solution, and good drainage of solution excess.

- There are different hydroponic ssytems by the way the nutrient solution is delivered.

- Growing medicinal and aroamtic plants in hydroponic systems need a rigourous monitoring and good knowledge on plants biology and cultivation technology in order to have the best relation between the type of the system and plant.

- Medicinal plants cultivated in hydroponic systems resulted in higher concentrations of bioactive substances than those cultivated in soil.

- The aromatic herbs grown in hydroponic systems have signifently more flavour and aroma than those cultivated in soil.

REFERENCES:

1. George pattenson, A Brief History of Hydroponics, http://ezinearticles.com. (Last cited on 2010 Dec 28).
2. www.Grodan.com (Last cited on 2010 Dec 28).
3. Noucitta kehdi, Hydroponics and medicinal plant our research, info@eurohydro.com. (Last cited on 2010 Dec 28).
4. Keith Roberto, How to Hydrophonics, 4th edition, The Future garden press,59,(2003).
5. Mohsen Daha and colleagues foothill hydroponics, Easy gardening, Students and home hobbyists, (3-34).
6. KEHDI NACETTA, 2012, *In search of adequate substrate*, General hydroponics, Hydropon East Magazine
7. KEHDI NACETTA, 2013, *Water as a substrate*, General hydroponics, Hydropon East Magazine
8. RAVIV M., L. HEINRICH, 2008, *Soiless cultures – theory and practice*, Elsevier B.V., UK
9. RESH H.M., 2013, *Hydroponic Food Production*, Ed. Woodbridge Press Publishing Company, California, USA.