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A Review on Technique of Growing Vegetables Without Soil - Hydroponics

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ABSTRACT

Soil-based agriculture is facing some major challenges with the growth of civilization everywhere the globe, like decrease per capita land availability, except this, thanks to speedy urbanization and industrial enterprise as threats from global climate change and its connected adverse result, the land cultivation is going to face difficult threats, beneath such circumstances, within the close to future it becomes involved to feed the completepopulation using commercial farming system. Naturally, soil-less culture is changing into additionalrelevant within the gift situation, to cope-up with these challenges. —Soilless Culture ‖ is that the growing of plants that imitate soil- base husbandry by victimization several varieties of growing media as for instanceinorganic substance, organic substance and artificial substrates. Soilless culture is that the quickest growing sector of agriculture, and it may be impetus to food production within the future. The business is anticipated to grow exponentially conjointly in future, as conditions of soil growing changing into troublesome. the applying of a soilless culture system victimizing artificial substrates would lead to economical and effective use of water and fertilizers and minimize the employment of chemicals for gadfly and sickness management. Plants grown in soil less culture has shown superior quality, high yield, speedy harvest, and high nutrient content. however just in case of developing countries there's a scarcity of its customary acquaintance and poor dissemination of its available technologies. For popularization of soilless culture at international level, it's terribly imperative to produce scientific proved technology to gardeners and build mass awareness in potential areas at internationallevel.

Keywords: Aeroponics, Hydroponics, Nutriculture, Open Field Agriculture, Soil-Less Culture

I. INTRODUCTION

Soil is the foremost accessible growing medium for plants. It provides anchorage, nutrients, air, water, etc. for fortunate plant growth. However, soils do cause serious limitations for plant growth too, at times. Additionally, typical crop growing in soil (Open Field Agriculture) is somewhat troublesome because it involves massive area, heap of labor and enormous volume of water. Moreover, some places like metropolitan areas, soil isn't available for crop growing in some areas, we discover deficiency of fertile cultivable land due to their unfavorable geographical or geographics conditions. Of late, another significant issue full-fledged since is that the issue to rent labour for typical open field agriculture. Beneath such circumstances, soil-less culture is introduced with success.

Soil-less culture refers to the techniques of Hydroponics ‘and Aeroponics‘. The term ‗Hydroponics ‘was derived from the Greek words ‗hydro’ suggests that water and ‗ponos’ suggests that labour. It’s a way of growing plants using mineral nutrient solutions, whitout soil. Terrestrial plants could also be fully grownwith their roots within the mineral nutrient answer solely or in Associate in

nursing inert medium, like perlite, gravel, or nonconductor. Singh and Singh (2012) additionally opined that hydroponic is that technique of growing plants in soil-less condition with their roots immersed in nutrient. this technique helps to face the challenges of global climate change and additionally helps in production system management for economical utilization of natural resources and mitigating deficiency disease. Aeroponics 'is another technique, a lotof orless like hydroponics with solely distinction that beneath aeroponics plants are fully grown with fine drops (a mist or aerosol) of nutrient solution.Interest in implementing of nutriculturedeveloped in 1925 once the green house business expressed interest in its use. In 1929, Dr. William F. Gericke of the University of CA succeeded in growing tomato vines of 7.5 m height in nutrient solutions. He named this new production system —hydroponics. In India, hydroponics was introduced in year 1946 by W. J. ShaltoDuglas and he established a laboratory in Kalimpong, West Bengal. He has additionally written a book namedas "Hydroponics- the Bengal System". in a while throughout Nineteen Sixties and 70s, commercial hydroponics farms were developed in , Arizona, Belgium, California, Denmark, German, Holland, Iran, Italy, Japan, Russia and different countries. Throughout Nineteen Eighties, several machine-controlled and computerized agriculture farms were established round the world.

II. DIFFERENT AVAILABLE TECHNIQUES FOR SOIL-LESSCULTURE

Large numbers of hydroponic/soil-less culture techniques are available. However, following factors are considered in selecting a technique:

1. Expected quality of the produce – colour, appearance, free from pesticides,etc.

We can classify the techniques asfollows:

2.1 Techniques ofhydroponics

It is also known as Liquid Hydroponics_ method. Plantsgrown in solution culture have their roots suspended directly in a nutrient solution. It can further be classifiedinto-

i) Circulating methods (closed system)/ Continuous flow solutionculture

a) Nutrient film technique(NFT)

b) Deep flow technique(DFT)

a)

b)

Fig 1. Different circulating methods (a) Nutrient film technique, (b) Deep flow technique [4]

Nutrient film technique (NFT)

NFT was developed within the middle Twenties in China by Dr. Alan Zhang Junior. In this system, the depth of the recirculating stream ought to be terribly shallow, very little flow of water, therefore the name 'nutrient film'. This ensures that the thick root mat, that develops within the bottom of the channel, has associate side, which is moist within the air. after this,

associate rich supply of oxygen is provided to the roots of the plants.

A properly designed NFT system is predicated on exploitation the correct channel slope, the correct flow, and therefore the right channel length. The plant roots are exposed to adequate supply of water, gas and nutrients. In earlier production systems, there was a conflict between the availability of those necessities, since excessive or deficient amounts of one ends up in an imbalance of one or both of the others. NFT, due to its style, provides a system whereby all 3 necessities for healthy plant growth may be met at constanttime, providing the easy thought of NFT is often remembered and practiced. The results of these benefits is that higher yields of high-quality turn out areobtained over associate extended amount of cropping culture systems can provide a consistent nutrient environment for roots.

Sources of nutrient elements

Table -4: Sources of nutrient elements with their characteristics

Source	Element	Characteristics
Potassium nitrate KNO_3	N, K	Very soluble salt
Potassium phosphate monobasic KH_2PO_4	P, K	Corrects phosphorus Deficiency
Magnesium sulfate $MgSO_4$	S, Mg	Cheap, highly soluble, pure salt
Iron chelate	Fe Cit	Best sources of Iron
Boric acid H_3BO_3	B	Best source of Boron
Calcium nitrate $Ca(NO_3)_2$	N, Ca	Very soluble salt

The frequency and volume of the nutrient solution applied depends on the type of substrate used (volume and monitoring of the system in necessary. Two aspects of physical – chemical characteristics), the crop (species and stage of development), the size of the container, the crop and irrigation systems used and the orevailing 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 willaffect their final yiels. 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 theamount of water normallyapplied , but without adding nutrients. Between 20% and 50% of the solution should be drained-off to prevent the accumulation of the toxicions and an excessive increases of electrical conductivity in the root area. The excess DESIRABLE pH RANGE OF NUTRIENT

SOLUTIONS

In hydroponic systems, pH is constantly changing as the plant grows. Changes in pH of less than 0.1 unit are not significant. Thus pH control is a necessity in hydroponic solutions. The pH range of 5.5 to 6.5 is optimal for the availability of nutrients from most nutrient solutions for most species, but species differ significantly and several can grow well outside of this range.

CONTROL OFCONTAMINANTS

Maintenance of sterile root-zone environment is essential to have good plant vigour under soil-less culture. It is extremely difficult to achieve and critical to minimize population of plant pathogens in the root zone. Commonly encountered disease in hydroponic solution is wilt, caused by Fusarium and Verticillum.

Species of Pythium and Phytophthora destroys all but the main roots. No effective fungicides are there which can be safely used in hydroponics. Only Metalaxyl has been found highly effective for control of Pythium on vegetable crops, but it is not registered for the use. Heat treatment of nutrient solution has also been found effective in keeping the root-zone free of pathogens.

Hydroponic averages compared with ordinary soil yields

Sources of nutrient elements are

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.

III. CONCLUSION

The industry is expected to grow exponentially also in future, as conditions of soil growing is becoming difficult. Specially, in a country like India , where urban concrete conglomerate is growing each day , there is no option but adopting soil-less culture to help improve the yield and quality of the produce so that we can ensure food security of our country.

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