

An Experimental Study of Crop Growth for Conservation of Land and Water in Hydroponics: A Soil-less System

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ABSTRACT: Today's world is on its own speed of attaining the technology in every aspect of daily life. The increasing technology also has put lot more negative impacts on human life. The main drawback is that the increasing rate of scarcity of water and the rise of concrete structures by creating an availability of fertile land for agriculture. So to control such negative impacts a new technology has emerged called hydroponics that uses no soil for the cultivation of soil and consumption of water is way less compared to conventional method. Therefore helping in conservation of land and water.

KEYWORDS: Hydroponics, Cultivation, Conservation

I. INTRODUCTION

Land is one of the important element for development of life on earth and water is one such element that is unavoidable in daily life. Agriculture mainly depends on these two elements for food production. As the technology is growing, it is leaving its negative foot prints in all the fields. It is being the reason for the rise of absurd effects in availability of fresh water and efficient land. Uneven rainfall and the increasing construction has led to difficulty in providing land and water for food production. Global warming is also adding up to the scarcity of water. So to control the increasing intensity of such negative impacts, there is a technique slowly developing that can put a stop to use of soil and can save large amount of water for crop growth i.e., the hydroponics.

Hydroponics is soilless culture. "Hydroponics" was sired by Dr. W.F. Gericke in 1936 to depict the advancement of attractive and favour plants created in an answer of water and separated supplements. It really suggests working water; "hydro" meaning "water" and "ponos" connoting 'work'.

A few spots like metropolitan territories, soil is not accessible for harvest developing by any means, or in a few regions, we discover shortage of fruitful cultivable arable terrains due to their negative geological or geographical conditions. Generally, another major issue experienced since is the trouble to contract work for traditional open field horticulture. Under such conditions, soilless culture can be presented effectively. The act of hydroponics touched base in India in 1946, when the legislature of Bengal began an exploratory ranch at Kalimpong in the Darjeeling District, as indicated by a review of the historical backdrop of hydroponics in India.

II. RELATED WORK

The hydroponics technique has overcome the problems of conventional farming such as producing higher yield, consuming less amount of water, eliminating the plant disease, no use of soil. The growth of seasonal plants can be

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor & UGC Approved Journal)

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Vol. 6, Issue 8, August 2017

grown in hydroponics irrespective of the season .Provision of equal amounts of nutrients to the plants for the efficient growth is made in hydroponics. Installation of sensors can be done for the emphasized monitoring of the crop growth every day. The crop period or the base period of a particular crop can be seen to be reduced in the hydroponic system.

There are six main types of Hydroponic systems. The other main system is Aeroponic. Hydroponic system can be semi-automated and completely automated. It is also seen that fodder can be cultivated for the cattle's in all the seasons which in turn bring a reduction in the grazing rate and the soil erosion can be lessened to a good level according to the study of different literatures.

The hydroponic type used for the present study in Nutrient Film technique hydroponic system which is efficient and is an easy handling system for the crop growth.

III. METHODOLOGY

The crops selected for the experimental study were spinach seeds, Amaranthus seeds and Pakchai seeds. The number of seeds selected for the study were six seeds from each crop group. The germination of these seeds was carried out in the substrate, used instead of soil was Rockwool. As rock wool possesses the ability to hold water, retains moisture content required for the growth of the crops. The watering to the crops was done in few millilitres of water. The germinating duration was achieved at 20 days to reach a desirable height of the seedlings.

After once the germination was done the seedlings from the along with the substrate was transplanted to the nutrient film technique hydroponic system. This NFT system is a circulatory system.

This NFT system used for the study consisted of 3 pvc pipes arranged in a horizontal manner with 6 slots carved in each of the pipe. This whole arrangement is supported by a stand and the same system s connected to a water tank placed below the stand. The front end and the rear end of all the three pipes was connected to the water tank. The water tank supplies nutrient solution mixed with the water to the seedlings placed in the slots with the help of the electricity. The main factors that were maintained throughout the growth of the growth were pH and total dissolved salts. The former was maintained between 5.5-6.5 and the latter was maintained between 1200-1400 ppm.

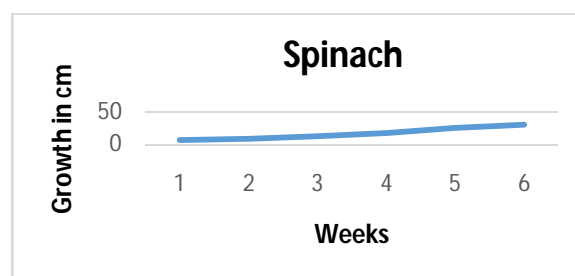
The whole set up of NFT and the germination was carried under the green net shed where the temperature was maintained to be. There was a sufficient provision provided for the allowance of the solar energy.

IV. EXPERIMENTAL RESULTS

The following graphs shows the rate of growth along with the height of seedlings of all the three crops in the NFT system and their respective crop period.

1. Rate of Growth of Spinach

The graph here explains the rate of growth of Spinach and its respective base period as mentioned below



Graph .1. Growth rate of Spinach

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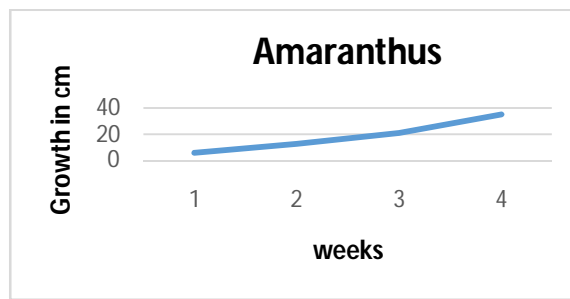
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Vol. 6, Issue 8, August 2017

The above graph shows the growth of spinach for 6 weeks from the day of transplantation. It is seen that the growth of the spinach has gradually increased and reached its harvesting stage by the end of sixth week i.e., the base period or the crop period was found to be 40 to 45 days. The crop period of spinach in conventional method is studied to be for 60 to 70 days. Hence the growth of Spinach was seen to be more effective and disease free in hydroponic system with less consumption of water. This one system proved to be effective for the speedy growth of Spinach irrespective of the seasons.

2. Rate of Growth of Amaranthus

The graph here explains the growth rate of Amaranthus and its respective base period as mentioned below

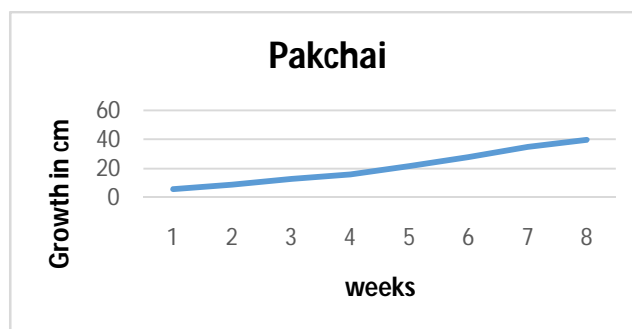


Graph 2. Growth rate of Amaranthus

The above graph shows the growth of Amaranthus for 4 weeks from the day of transplantation. The growth of the Amaranthus is seen to be reaching around 35 cm and its harvesting stage is reached within 4 weeks. The base period was found to be 30 to 35 days while the base period of 90 to 110 days in conventional method according to the studies made. The branches of Amaranthus were seen to be thicker in the hydroponic cultivation and the edible form of Amaranthus was disease free.

3. Rate of Growth of Pakchai

The graph here shows the rate of growth of Pakchai and its respective base period as mentioned below



Graph 3. Growth rate of Pakchai

The above representation of graph shows the growth of pakchai which is even called as Chinese cabbage. The growth of this plant is seen to be increasing in a rapid way. The base period of pakchai was seen to be 45 to 50 days while in the conventional method the base period is 50 to 80 days as per the studies made.

International Journal of Innovative Research in Science, Engineering and Technology

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Website: www.ijirset.com

Vol. 6, Issue 8, August 2017

V. CONCLUSION

In the above study it was showed that the growth of the plants was observed to be faster, wholesome and health-giving in the hydroponic system. The plants considered for the study were found to be disease free and the yield was found greater in the hydroponic system as all the six seedlings of each crop group reached their harvesting stage. The crop period of the three plants was found to be less than that of the crop period of plants in conventional method. For the present the type of hydroponic system used is of NFT type. The water required for the system for a day was to an approximate value of 1 litre per day. The storage tank holds the capacity of 30liters of water.

Considering the experimental set up scale to be equivalent to 1m² area i.e., 10.7584 sq.ft requires 1 litre per day.

Similarly for a 1 acre of land for the hydroponic set up the water required is i.e., for 43560 sq.ft of area is 4048.9 litres per day.

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