

Standardizing the Device of Hydroponics System for Study of Different Parameter of the Plant Growth in Laboratory

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Abstract: *Hydroponics technique of plant cultivation is trending as an innovative and novel method in crop production without soil. The mass level established hydroponics system are available. But the procuring such large set of hydroponics systems for small research laboratories is not economically viable. In current research a small affordable hydroponics system is developed that required the minimum resources, space and maintenance. This hydroponics set up is found very helpful to study the effect of different parameters on the plant growth under given conditions. Here the effect of parameter like light exposure, liquid nutrients, aeration conditions on the plant growth and development was noted, and feasible recommendations are made for betterment of plant growth.*

Keywords: Hydroponics, light exposure, liquid nutrients, plant growth

I. INTRODUCTION

Being agriculture-oriented nation, India has its own traditional practices. Agriculture is the backbone of the Indian economy as well as plays a direct role in the food security. India has second largest population in the world, and increasing population add as additional burden on current crop productivity. Thus, the agricultural sustainability is the one of the fundamental issue of the nation. The crop management and enhancement of the crop productivity is very important to fulfil the goal of food demand.

Indian people are started to develop various innovative practices in the farming to enhanced the crop productivity (Chauhan *et al*, 2012). Now a days the farmers are adopting various new methods to improve their crop management and better farming to avoid the yield loss. Proper management of the available land is the again one of the major factors to get the benefits from agriculture and it is possible through vertical farming. The motive behind the vertical framing is, enhancement of the yield of crop product under minimum utilization of the land and other resources (Touliatos *et al*, 2016; Al-Kodmany, 2018).

Hydroponics it is the best example of the vertical farming, it is a technology of growing plants by using water or nutrient-rich solution, without soil, under a controlled condition. It uses nutrient solution that contain all the essential nutrients needed by the plant in a form that is completely similar to those absorbed from the soil (Sharma *et al*, 2018; Despommier, 2018; Srivani, *et al*, 2019; Chatterjee, *et al*, 2020). Basically, this nutrient solution is water dissolved liquid fertilizer which fulfil all the basic requirement of plant growth and easily available in market.

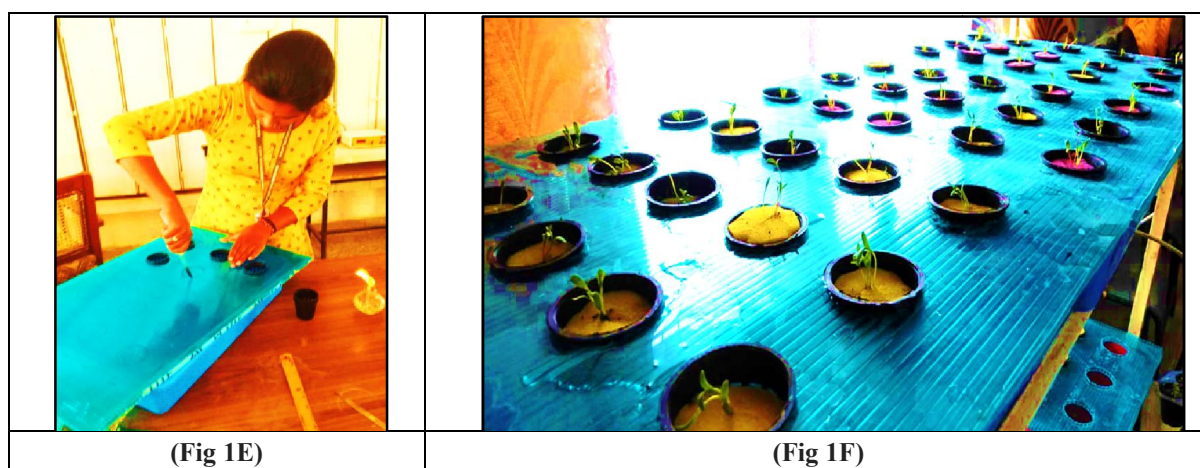
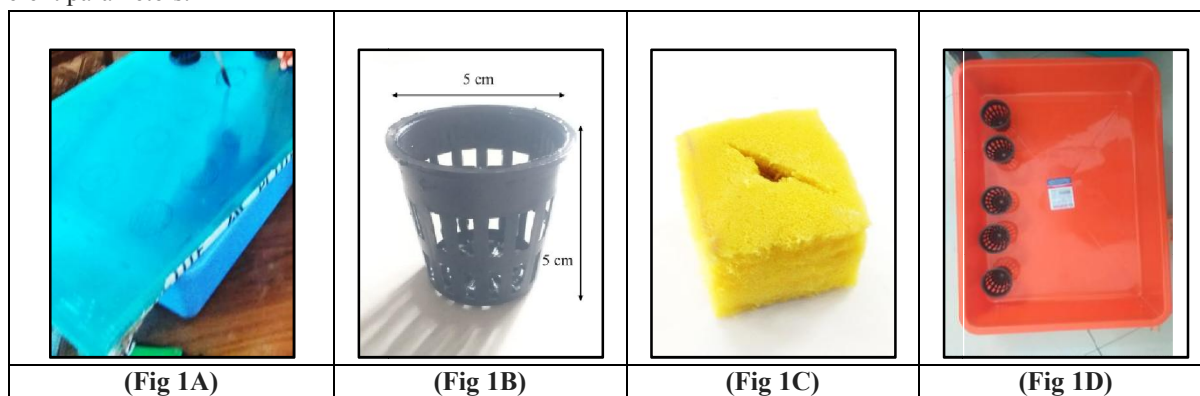
Standardization of liquid fertilizer is one of the important phenomena before cultivating the crop by using the hydroponics method. Liquid fertilizer is more suitable to which crop plants or vegetable plants it may conclude on the basis of the plant growth case study by using variety of liquid fertilizer. Along with the role of liquid fertilizers, the impact of other parameters like of light exposure, aeration conditions and their impact may also studied on the plant growth. To standardize the device and set the protocol for all the parameters of hydroponics needs large scale experiment of plant growth case study which usually require high resources, huge space and high maintenance. To conserve the space, resources and minimize maintenance there is need to develop a miniature of hydroponics device. In current research a small hydroponic device was developed with minimum resources and a case study was done to note the effect of light and aeration on plant growth and development.

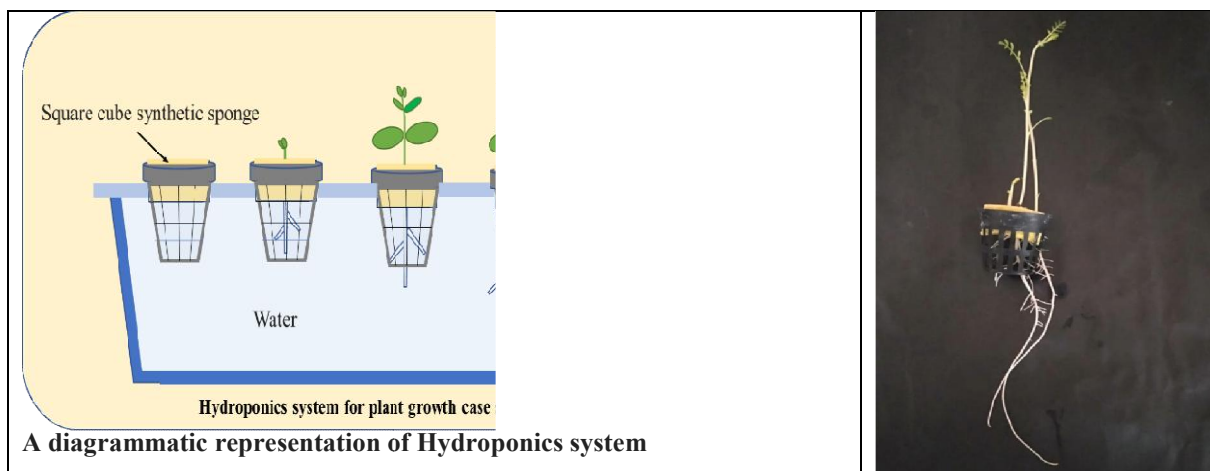
II. MATERIAL AND METHOD

1. In order to grow the plants in hydroponic system there is a need of hollow plastic board (Fig 1A), germination baskets (Fig 1B), square cube synthetic sponge (Fig 1C) and plastic tray (Fig 1D) as a water reservoir having a of 10 litter water filling capacity.
2. To fix the germination basket in the hollow plastic board, round shape wholes are made by using metal scalpel as per the diameter of basket. Metal scalpel must be heated first on flame for proper cutting. Marking the round outline with help of marker is very helpful for the proper round shape cutting. (Fig 1E)
3. Square cube of sponge was taken and oblique cut is given end to end from the middle and this sponge was installed in the germination basket. (This sponge is getting fixed in germination basket very tightly and act as the plant holder while growth of the plant.
4. After the installation of sponge loaded germination basket in the round whole of hollow plastic board as shown in the figure 1E. Keep this plastic board on the plastic tray which fulfilled with water.

Then fully imbibed seeds were inoculated inside each sponge of germination basket and this assembly was kept as it is until the seed became germinate.

After the successful germination of the seed this hydroponic setup were used for case study of plant growth under the different parameters.





III. RESULTS AND DISCUSSION

During the study of hydroponics various experimentation were conducted for the standardisation this device. Outdoor and indoor hydroponics setups are studied, it is found that hydroponics system shows significant result in indoor setup as compare to outdoor setup. Indoor setup is facilized with artificial light source and the indoor atmospheric conditions are under control. Inoculation of young plantlets in the sponge cube of this system is possible but during this inoculation there is chance of the root damage, that affect the plants growth. As compare to this, the inoculation of imbibed seed in sponge cube is better for plant growth. sponge maintained the moisture around the imbibed seed that helps in the seed germination. Some seed may be nonviable that can be replace very easily with another germination basket having a germinated plantlet. Exposure of artificial light affect the germination while the dark condition without any exposure of light is found more suitable for the process of the seed germination. Once the seed germinated artificial light source is provided more than 12 hours is found beneficial shoot development (Duttaet al, 2012; Guptaet al, 2017). Hollow plastic sheet may transmit the light in side the water container that affects the proper root development to avoid this the plastic sheet was covered by the paper pulp, this layer of paper pulp keeps the light away from the root system (MacDonald, 1976). After the 4 to 5 days of shoot development this hydroponics system were treated with the different liquid fertilizers for the plant growth case study.

IV. CONCLUSION

The small hydroponics device developed with minimum resources which occupy minimum space of laboratory. The vertical metal rack is able to carry the weight of this hydroponics systems. The plant growth, case study under hydroponics conditions could be done easily and effect of different liquid fertilizers on the growing plants is possible, by using this hydroponics system. Different parameters of the hydroponics could be studied efficiently using this set up of hydroponics.

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