TRAINING REPORT
ON
10 WEEKS EXPERIMENTAL LEARNING

This report is submitted in partial fulfillment of the requirements for the award of Degree of

BACHELOR OF TECHNOLOGY
IN
AGRICULTURAL ENGINEERING

By

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CERTIFICATE

This is to certify that, training programme entitled "**10 WEEKS EXPERIMENTAL LEARNING**" is a bonafied work of **SAURAV KUMAR** submitted in partial fulfillment of the requirements for the awards of degree of Bachelor of technology in agricultural engineering in the Integral Institute of Agricultural Science and Technology, Integral University.

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I, SAURAV KUMAR, solemnly declare that this internship report on 10-Weeks Experimental Learning is written and submitted by me to Integral Institute of Agriculture Science and Technology, IUL. I further declare that I have strictly observed reporting ethics and duly discharged copy-right obligation and properly referred all outsourcing of materials used in this report and nothing is confidential in this report in respect of the company of my internship.

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ABSTRACT

Currently hydroponic cultivation is gaining popularity all over the world because of efficient resources management and quality food production. Soil based agriculture is now facing various challenges such as urbanization, natural disaster, climate change, indiscriminate use of chemicals and pesticides which is depleting the land fertility. Several benefits of this technique are less growing time of crops than conventional growing; round the year production; minimal disease and pest incidence and weeding, spraying, watering etc can be eliminated. Commercially NFT technique has been used throughout the world for successful production of leafy as well as other vegetables with 70 to 90% savings of water. Leading countries in hydroponic technology are Netherland, Australia, France, England, Israel, Canada and USA. For successful implementation of commercial hydroponic technology, it is important to develop low cost techniques which are easy to operate and maintain; requires less labor and lower overall setup and operational cost.

INTRODUCTION

Hydroponics is a technique of growing plants in nutrient solutions with or without the use of an inert medium such as gravel, vermiculite, rockwool, peat moss, saw dust, coir dust, coconut fibre, etc. to provide mechanical support. The term Hydroponics was derived from the Greek words hydro' means water and ponos' means labour and literally means water work. The word hydroponics was coined by Professor William Gericke in the early 1930s; describe the growing of plants with their roots suspended in water containing mineral nutrients. Researchers at Purdue University developed the nutriculture system in 1940. In doing so he termed this nutriculture systems "Hydroponics". During 1960s and 70s, commercial hydroponics farms were developed in Arizona, Abu Dhabi, Belgium, California, Denmark, German, Holland, Iran, Italy, Japan, Russian Federation and other countries. Most hydroponic systems operate automatically to control the amount of water, nutrients and photoperiod based on the requirements of different plants (Resh, 2013). Due to rapid urbanization and industrialization not only the cultivable land is decreasing but also conventional agricultural practices causing a wide range of negative impacts on the environment. To sustainably feed the world's growing population, methods for growing sufficient food have to evolve. Modification in growth medium is an alternative for sustainable production and to conserve fast depleting land and available water resources. In the present scenario, soil less cultivation might be commenced successfully and considered as alternative option for growing healthy food plants, crops or vegetables (Butler and Oebker, 2006). Agriculture without soil includes hydro agriculture (Hydroponics), aqua agriculture (Aquaponics) and aerobic agriculture (Aeroponics) as well as substrate culture. Among these hydroponics techniques is gaining popularity because of its efficient management of resources and food production. Various commercial and specialty crops can be grown using hydroponics including leafy vegetables, tomatoes, cucumbers, peppers, strawberries, and many more. This article covers different aspect of hydroponics, vegetables grown in hydroponics system and global hydroponic market.

HYDROPONIC STRUCTURES AND THEIR OPERATION

Hydroponic system are customised and modified according to recycling and reuse of nutrient solution and supporting media. Commonly used systems are wick, drip, ebb-flow, deep water culture and nutrient film technique (NFT) which are described below.

- Wick System: - This is simplest hydroponic system requiring no electricity, pump and aerators. Plants are placed in an absorbent medium like coco coir, vermiculite, perlite with a nylon wick running from plant roots into a reservoir of nutrient solution. Water or nutrient solution supplied to plants through capillary action. This system works well for small plants, herbs and spice and doesn't work effectively that needs lot of water.
- Ebb and Flow system: - This is first commercial hydroponic system which works on the principle of flood and drain. Nutrient solution and water from reservoir flooded. Diagram of various structures of hydroponic system through a water pump to grow bed until it reaches a certain level and stay there for certain period of time so that it provide nutrients and moisture to plants. Besides, it is possible to grow different kinds of crops but the problem of root rot, algae and mould is very common (Nielsen et al., 2006) therefore, some modified system with filtration unit is required.
- Drip system: - The drip hydroponic system is widely used method among both home and commercial growers. Water or nutrient solution from the reservoir is provided to individual plant roots in appropriate proportion with the help of pump. Plants are usually placed in moderately absorbent growing medium so that the nutrient solution drips slowly. Various crops can be grown systematically with more conservation of water.
- Deep water culture system: - In deep water culture, roots of plants are suspended in nutrient rich water and air is provided directly to the roots by an air stone. Hydroponics buckets system is classical example of this system. Plants are placed in net pots and roots are suspended in nutrient solution where they grow quickly in a large mass. It is mandatory to monitor the oxygen and nutrient concentrations, salinity and pH as algae and moulds can grow rapidly in the

reservoir. This system work well for larger plants that produce fruits especially cucumber and tomato, grow well in this system.

- Nutrient Film Technique (NFT) system: - NFT was developed in the mid 1960s in England by Dr. Alen Cooper to overcome the shortcomings of ebb and flow system. In this system, water or a nutrient solution circulates throughout the entire system; and enters the growth tray via a water pump without a time control. The system is slightly slanted so that nutrient solution runs through roots and down back into a reservoir. Plants are placed in channel or tube with roots dangling in a hydroponic solution. Although, roots are susceptible to fungal infection because they are constantly immersed in water or nutrient. In this system, many leafy green can easily be grown and commercially most widely used for lettuce production.

Fig. 1

DESIGN & DEVLOPMENT OF A PVC PIPE BASED HYDROPHONIC SYSTEM

PVC is a man-made polymer solid and one of the world's most utilized plastics. This plastic is known by its full name polyvinyl chloride, simply as vinyl and perhaps best known by its abbreviation: PVC. Polyvinyl chloride is produced through a chemical synthesis reaction that allows PVC to be manufactured into many product forms that are intended for various applications. PVC is a highly versatile material capable of being produced in either flexible (*PVC*) or rigid (*UPVC*) forms, with color or as translucent clear and according to required shapes and sizes.

In my project I have used the rigid as well as flexible pvc pipes for different work.

I took a '4ft 9 inch' long Pvc rigid pipe and did seven holes in a pipe which diameter '2 inch' with the help of a drill machine. The spacing of holes is '5 inch' and placed end caps at similar ends. I took another 23 pipes and repeated the same process to prepare the three setups. Now make the hole in the middle of the end cap which 'diameter 2 cm' of either ends in six pipes because it will be placed in the upper stand. One side will receive the water and another side will pass the water to another pipe. The diameter of inlet & outlet is '2cm'. In remaining pipes I did one hole at the upper side of end cap of one end to receive water and at another end I did the hole in the middle of the end cap to pass the water in another pipe. The length of outlet connection pipe are '34 inch' and diameter '1.5 cm'. After preparing holes I put '2 inch' diameter pot in that hole so that the roots will receive the nutrient water from the pipe.

Fig. 2

Now the motor is placed in the tank which is filled with ‘250 litres’ of water. And the pipe is connected to the motor. And the another end of pipe of pipe is connected with steel coupler to provide water to the pipes as shown in the figure 3.

Fig. 3

The green pipe (refer fig. 3) is connected with the motor and providing water to the hydroponic system. After this the receiving pipe provides water to the pipe which is kept on the top.

Fig. 4

Fig. 4 represents the outlet of water from the last pipe. The outlet pipe is joined to maintain the flow of water in the pipe regularly and to prevent overflow.

Nylon cable tie is used to tie the pipes so that they don’t move from their places. This is done because if pipe will move from their respective place the overflow may occur that will cause the wastage of nutrient water. Fig. 5 represents nylon cable tie.

Fig. 5

Fig.6

In above figure we can see that spinach is ready for harvesting. It is harvested by using scissor. It is not fully cut by their roots instead it is cut from above of root so that again the crop will grow in the same system.

As we know that we can grow more crops in less area as well as more nutrient rich crop in the hydroponic system, but if there are some advantage of this system there are some disadvantages are also there.

So some of the advantages and disadvantages are discussed below;

Advantages of hydroponic: -

- In a highly customized &controlled environment, plant growth accurate.
- So they need much smaller root system &can divert more energy in to leaf& steam system
- Without the mechanical resistance of the soil, seeding can mature much faster
- With smaller roots you can grow more plants in the same area & get more yields from the same amount of ground.
- By controlling the Environment of plant many risk factor like fungus, pests, are reduced.

- Hydroponic system and the unpredictability of growing plants outdoors &in the earth.
- By eliminating pesticides, hydroponic, produce much healthier & high quality fruits &vegetables.

Disadvantages of hydroponic:-

- Cost of all the equipment for hydroponic, containers, pumps, lights, nutrients, & so on.
- Hydroponic is more scientific, you need to check them constantly to make sure they are growing in exactly the conditions they need.
- It have much smaller root system ,they can't always support themselves very well
- Heavy fruiting plants may need quite elaborate from of support.