AgriCos e-Newsletter
ISSN: 2582-7049
Volume: 02 Issue: 04 April 2021 Article No: 41

Hydroponic: A Novel Technique of Green Fodder Production

Surve V. D.[1] and Kamble S. A.[2]

[1]Associate Professor and [2] M. Sc. Student, Department of Post Harvest and Food Biotechnology, V D College of Agricultural Biotechnology, (VNMKV, Parbhani) Latur, (M.S.)

SUMMARY

Soils do pose serious limitations for plant growth too. Presence of disease causing organisms and nematodes, unsuitable soil reaction, unfavorable soil compaction, poor drainage, degradation due to erosion etc. are factors responsible for deprived growth of plants. Soil-less culture can be introduced successfully to cope up the problems viz. scarcity of fertile cultivable arable lands and unfavorable geographical conditions. Soil-less culture mainly refers to the techniques of Hydroponics and Aeroponics. The term Hydroponics was derived from the Greek words hydro' means water and ponos' means labour. It is a method of growing plants using mineral nutrient solutions, without soil. The present study on Hydroponics fodder production is a rational solution for the year-round production of feed in case of animals without land and pastures shortages in all regions and climatic zones. There is no post-harvest loss of fodder as seen in the conventional practices (hay and silage making) as the hydroponics fodder can be produced as per the daily requirement. This system helps to face the challenges of climate change and also helps in production system management for efficient utilization of natural resources and mitigating malnutrition. There are added advantages of round the year similar high quality fodder supply to the farm, which are free from antibiotics, hormones, pesticides, or herbicides. It is a well-accepted fact that feeding animals is incomplete without including green fodder in their diet. Green fodder plays major role in feed of milch animals, thereby providing required nutrients for milk production and health of the dairy animals. Therefore, for sustainable livestock farming, quality green fodder should be fed regularly to the dairy animals. Non-availability of irrigated lands for fodder production, higher labour cost, and small land holdings has left dairy farmer with many challenges for milk production in area due to this hydroponics technology comes in frame.

INTRODUCTION

Soil is usually the most available growing medium for plants. It provides anchorage, nutrients, air, water, etc. for successful plant growth. In addition, conventional crop growing in soil (open field agriculture) is somewhat difficult as it involves large space, lot of labor and large volume of water. Moreover, some places like Metropolitan areas, soil is not available for crop growing at all, or in some areas, we find scarcity of fertile cultivable arable lands due to their unfavorable geographical or topographical conditions. Another serious problem experienced since is the difficulty to hire labour for conventional open field agriculture. Under such circumstances, soil-less culture can be introduced successfully. The term Hydroponics was derived from the Greek words hydro' means *water* and ponos' means *labour*. It is a method of growing plants using mineral nutrient solutions, without soil. Terrestrial plants may be grown with their roots in the mineral nutrient solution only or in an inert medium. Hydroponics is the technique of growing plants in soil-less conditions with their roots immersed in nutrient solution. This system helps to face the challenges of climate change and also helps in production system management for efficient utilization of natural resources and mitigating malnutrition. In India, Hydroponics was introduced in year 1946 by an English scientist, W. J. Shalto Duglas and he established a laboratory in Kalimpong area, West Bengal. He has also written a book on Hydroponics, named as Hydroponics, The Bengal System. Later on during 1960s and 70s, commercial hydroponics farms were developed in Abu Dhabi, Arizona, Belgium, California, Denmark, German, Holland, Iran, Italy, Japan, Russian Federation and other countries. During 1980s, many automated and computerized hydroponics farms were established around the world. Home hydroponics kits became popular during 1990s.

As livestock population increases, a large gap exists in between requirement and availability of feed and fodder. India is short in dry fodder by about 23.46 per cent, green fodder 62.76 per cent, concentrate 30 per cent. It is a well accepted fact that feeding animals is incomplete without including green fodder in their diet. Green fodder plays major role in feed of milch animals, thereby providing required nutrients for milk production and health of the dairy animals. Green fodder is an essential component of the livestock ration; otherwise the productive and reproductive performance of animals is adversely affected. Therefore, for sustainable livestock farming, quality green fodder should be fed regularly to the dairy animals. Rapid urbanization and mining areas

has caused shrinkage of grazing and fodder producing lands. Due to non availability of quality green fodder throughout the year, milk producers are forced to utilise extra concentrates for optimum milk production. Non availability of irrigated lands for fodder production, higher labour cost, and small land holdings has left dairy farmer with many challenges for milk production in area due to this hydroponics technology comes in frame.

Hydroponics Technology:

It is a science of growing plants in nutrients rich solutions instead of soil and can be efficiently used to take pressure off the land to grow green feed for the livestock. Plants require three things to flourish, water, nutrients, and sunlight. Hydroponics is a straight forward way of providing all these nutrients without the need of soil under controlled environment conditions to optimize the growth of plants.

Hydroponically Grown Green Fodder:

Hydroponics Technology has been tested on various crops as Maize, Sorghum, Barley, Oats and Wheat for producing high quality of nutritious green fodder for dairy animals. Beside this hydroponics can be used for growing wheat grass, paddy saplings etc in seven days of time for optimum growth. Fodder obtained from hydroponics consists of grass with grains, roots, stem and leaves as compared to only stem and leaves part in conventionally grown fodder. This process takes place in an intensive hydroponic growing unit where only water and nutrients are used to produce a grass and root combination that is very lush and high in nutrients. This greenhouse is a framed structure covered with a transparent material in which the crops could be grown under the conditions of at least moderately controlled environment. In this greenhouse the requirement of plants for water, light, temperature and humidity is maintained by water fogging and tube lights controlled automatically through the sensor of the control unit.

Green fodder production of Barley (*Hordeum vulgare*):

Barley (*Hordeum vulgare*) is a cereal grain that is commonly used in the finishing rations of cattle in the United states and Canada. These sprouts are high in protein and fiber, and are naturally balanced in protein, fat and energy. Compared to corn, barley fodder has 95% of the energy and higher digestibility. Barley fodder is one of the most nutritious sprouts and is full of essential nutrients, vitamins and minerals. Feeding of barley fodder will improve the overall health and wellbeing of animals. The main objectives of this study were to evaluate forage barley (*Hordeum vulgare*) for green fodder production and water efficiency under hydroponic conditions.

Procedure for Construction of Hydroponics Unit:

According to your fodder quantity of demand, you can build a Hydroponic fodder system unit.

- To build this unit, we require a little space, mostly farmers' use 10 ft x10 ft shade net to grow Hydroponic fodder. It is better to choose a shed net location near to the livestock shade to make operation easy.
- For full ventilation, leave some open space between the roof and side walls. When the unit is fully ventilated and airy; you can easily maintain the temperature and humidity.
- To grow hydroponic fodder, you require a medium size tray of about 1.5 x 3 ft. They must be made up of plastic and strong enough to hold the weight of the fodder.
- The seeds (Barley) must be kept moist and don't use metal trays to avoid rusting.
- Make 15-20 small size holes to trays to drain excess water. Within the shed, erect a bamboo rack or plastic rack or metal rack to hold these trays.
- Bamboo rack or plastic rack or metal rack should have three to four layers and height of that rack should be less (2-4ft) so that, it becomes very easy for spraying water and removing the trays.
- Keep enough space between two layers so that trays can easily removed and also create a slight slope for each layer to one side of the rack to drain water easily. Make a small drainage line under the side of a rack to drain out water.
- The experiment has been conducted under temperature-controlled conditions (24 ± 1°C).

Methodology for production of Green Fodder:

- Add 5-7 liters of warm water in a plastic bucket and seeds and remove seeds which float on the water because they will not sprout.
- Remove other impurities.
- After that add 50 -100 gm salt in water, it helps to minimize the chances of fungus infection on sprouted seed.
- Allow soaking for around 12 hours. After 12 hours drain the water and wash the seeds with clean water for one or two times.
- Transfer this washed seeds in a gunny bag and allow them to sprout. In a cold climate, they will take more than 24 hours to germinate while in a hot climate the seed will take about 24 hours.
- Before using the plastic tray, wash them properly and check the blockages. Transfer sprouted seeds from the gunny bags to trays and evenly spread them and place these trays on the rack.
- Every day sprinkle light water on sprouted seeds, with the help of sprinklers. In hot weather condition sprinkle water after every two hours and after 4 hours in cold weather conditions to maintain moisture. Always maintain cleanness in the shed. It helps to reduce chances of fungus /mold infection.
- Do not disturb the sprouted seeds from the trays until they are harvested.

Results:

The results showed that green forage can be produced within 10 days from germinating to harvest using hydroponic technique. Highest values for green fodder fresh yields were recorded for barley, which gave 09 kg/kg of seeds. However, only barley crops gave the highest yield as compared to maize and wheat, it might be due to proper utilization of water in barely crop. It can be concluded from this study that barley crop can be considered the best choice for production of hydroponic green fodder with less water consumption.

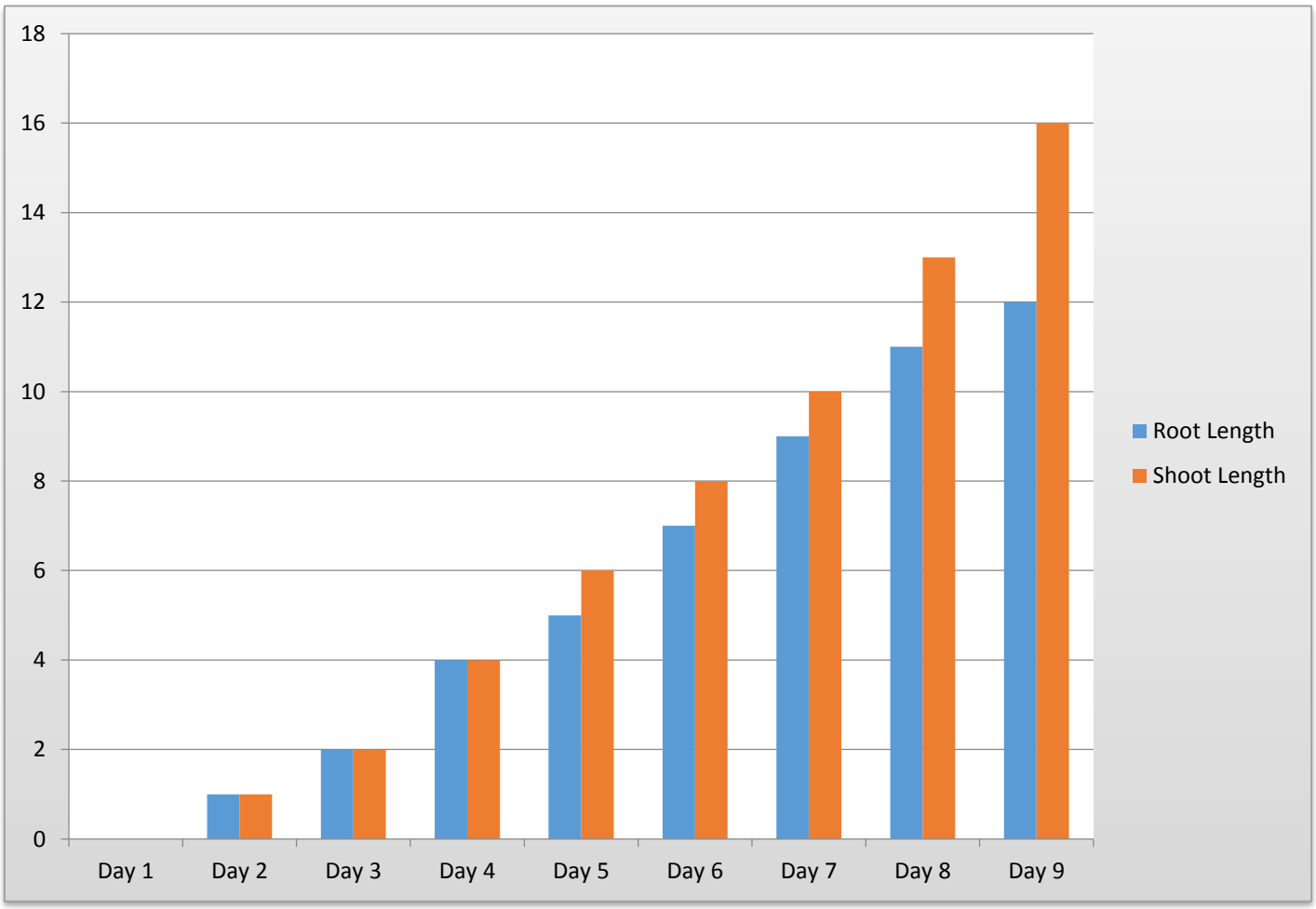


Table.1: Root and shoot length (cm) of Barley green fodder after nine days of growth under hydroponic fodder production system.

Fig 1

Fig 2

Fig 3

Fig 4

Fig 5

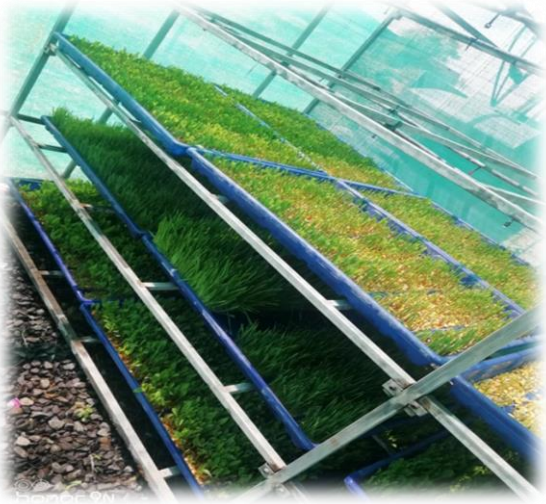
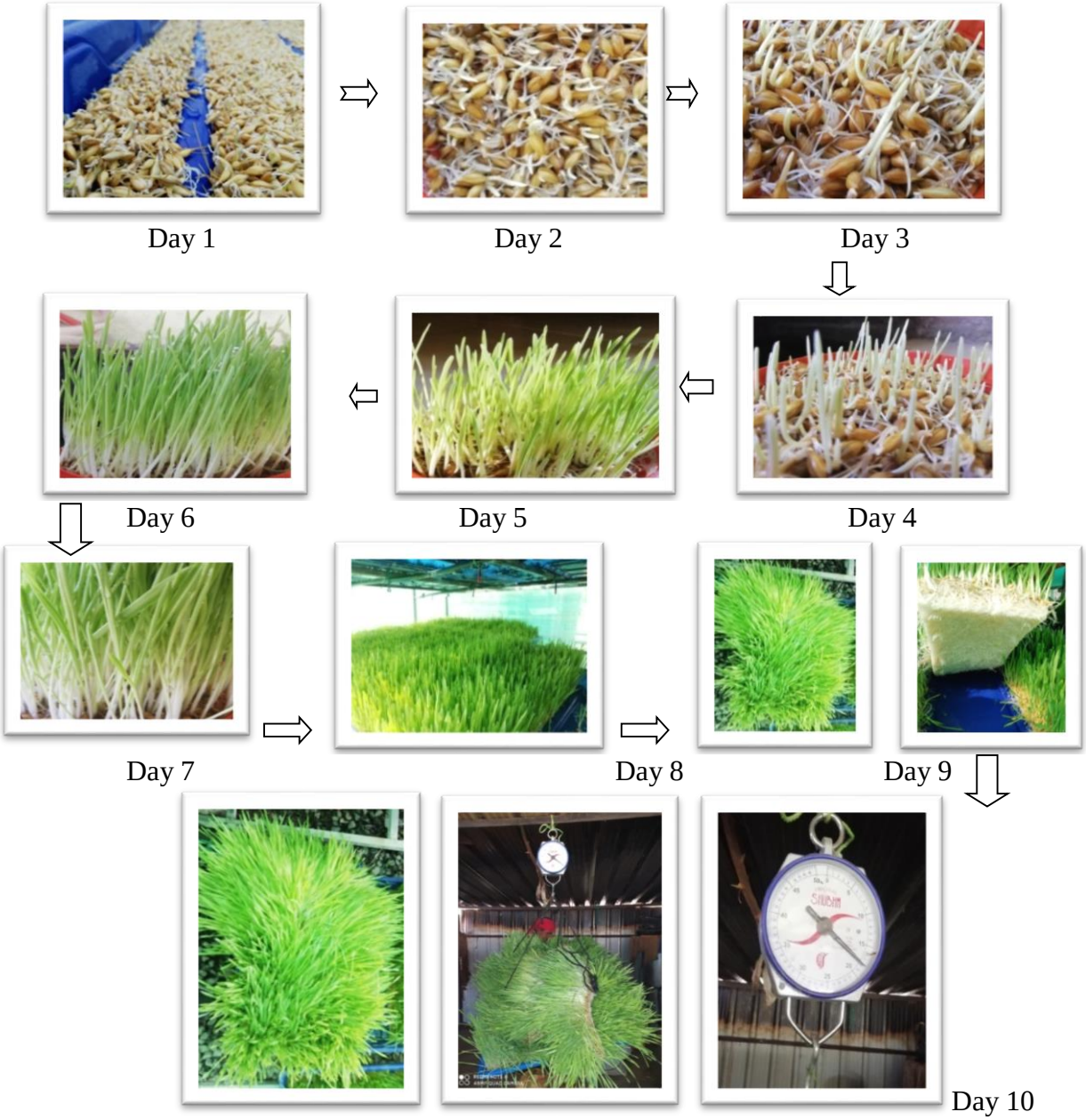


Fig 6

Figures 1-6: Growth of Green Fodder of barley seeds and Figure 4: Shifting of seed loaded tray on hydroponic unit.



Figures 7: Day to day growth of Green Fodder of barley seeds.

CONCLUSION

The present study on Hydroponics fodder production is a rational solution for the year-round production of feed and fodder of animals without land and pastures shortages in all regions and climatic zones. Farmers using this type of fodder production are guaranteed a consistent supply of quality fodder 365 days of the year. There is no post-harvest loss of fodder as seen in the conventional practices (hay and silage making) as the hydroponics fodder can be produced as per the daily requirement. There are added advantages of round the year similar high quality fodder supply to the farmer, which are free from antibiotics, hormones, pesticides, or herbicides. Constant food supply also allows farmers to retain their stock, selling them when the prices are suitable without acceptance of market prices due to poor quality livestock. Thus, hydroponic fodder system has the potential to allow farmers to yield a fodder that has ability to supply huge ecological and economical merits.

REFERENCES

Agius A, Pastorelli G, Attard E (2019). Cows fed hydroponic fodder and conventional diet: effects on milk quality. Arch Anim Breed, 62: 517–525.

AI-Karaki GN, AI-Hashimi M (2012). Green fodder production and water use efficiency of some forage crops under hydroponic condition. Internl Schol Res Network, https: /doi.org/10.5402/2012/924672.

Chavan JK and Kadam SS (1989). Nutritional improvement of cereals by sprouting. Critical Reviews in Food Science and Nutrition, 28: 401-437.

Dung DD, Godwin IR and Nolan JV (2010). Nutrient content and in sacco degradation of hydroponic barley sprouts grown using nutrient solution or tap water. J of Anim and Veterinary Adv, 9 (18): 2432-2436.

Emam MSA (2016). The sprout production and water use efficiency of some barley cultivars under intensive hydroponic system. Middle East J Agric 5 (2): 161-170.

Jahagirdar SK and Saha US (2007). Hydroponics Fodder Production: An Alternative Technology for Sustainable Dairying. Department of Economic Analysis and Research (DEAR), NABARD.

Jensen H, Malter A (1995). Protected agriculture a global review. World Bank technical pp 253-256.

Kide W, Desai B and Kumar S (2015). Nutritional improvement and economic value of hydroponically sprouted maize fodder. Life Sci Int Res J 2 (2) 76 – 79.

Naik PK (2012). Hydroponics technology for fodder production. ICAR News, 18 (3):4.

Naik PK, Swain BK, Singh NP (2013b). Low cost devices for hydroponics fodder production. Indian Dairyman, pp 68-72.

Naik PK, Swain BK, Singh NP (2015). Production and utilization of hydroponics fodder. Indian J Anim Nutr, 32:19.