

How to Implement Hydroponic Fodder System to Be More Beneficial for Farmers

¹Basavesh.D, ²Chandana.N, ³Pushpa.S

¹Assistant professor, ^{2,3}UG students, Department of ISE, CIT, Gubbi, TUMKUR, India.

¹basavesh.d@cittumkur.org, ²chandana.n06@gmail.com, ³pushpa.s1206@gmail.com

Abstract— This paper is aiming to identify the nutritional benefits and economic values of feeding hydroponically grown maize and barley fodder for cattle. Production of hydroponics fodder involves growing of plants without soil but in water or nutrient rich solution in a low cost devices for a short time approximately 7 days. The hydroponics fodder is like a mat of 20-30 cm height which consists of roots, seeds and plants. If we produce 1kg of fresh hydroponic fodder like maize, barley we require about 1.5-3 liters of water. A farmer uses hydroponic fodder for feeding their daily animals like cows, pigs, sheep, goat and birds using low cost devices. Therefore, it can be concluded that feeding of hydroponically grown maize and barley fodder for growing goats increased the total DM intake, feed conversion efficiency, body weight gain and economically valid. We are giving an idea to implement hydroponics fodder system in best way to help farmers that is by creating a society so that the investment made by an individual farmer will be less when compared with the investment made to implement the system on his own. If they create a society they will get more benefits from government in the name of schemes and subsidies. So implementing hydroponic fodder system in this way plays a major role in development of individual farmer which leads to development of rural area.

Keywords— Hydroponics, seed, hydroponic fodder, costs, nutrient.

I. INTRODUCTION

Soil is usually the most available growing medium for plants. It provides nutrients, air, water etc., for successful plant growth. However soil do pose serious limitations for plant growth too, at times. Presence of disease causing organisms, unsuitable soil reaction, unfavorable soil compaction degradation due to erosion etc., some of them. In addition, open field agriculture is somewhat difficult as it involves large space, lot of labor and large volume of water. Moreover, in some places like metropolitan areas soil is not available for crop growing at all, or in some areas, we find scarcity of fertile cultivable lands due to their unfavorable geographical or tropical conditions [1]. Other serious problem experienced is the difficulty to hire labors fir conventional open field agriculture. Under such circumstances, soil-less culture is introduced successfully.

Soil-less culture mainly refers to the techniques of 'Hydroponics' and Aquaponics. The term hydroponics was derived from Greek word 'hydro' means water and 'ponics' means labor. Hydroponics is a method of growing of plants using mineral nutrient solutions, without soil. Method of hydroponic fodder production date back to the 1930's. Fodder can be grown hydroponically much same as vegetable, flowers, and other plants. Hydroponic fodder systems are usually used to sprout cereal grains.

The Hydroponics fodder system is a temperature and humidity controlled growing room that is specifically designed to sprout grains that are very nutritious. The animal eats everything (i.e., roots, leaves, and nuts) therefore, the hydroponic fodder system is waste free, 100% sustainable and cost effective.

Hydroponics fodder is young tender grass grown from a cereal grain mostly barley. In a sense it replaces greens like dairy meal, pig's feeds and poultry feeds. Globally, hydroponic fodder is consider to be best livestock feed.



Fig1.1- Green Fodder

Green fodder is one of the important inputs and plays a major role in feed of milch animals. Green fodder provides required nutrients or mineral for milk production and health of the dairy animals or livestock.

II. ADVANTAGES OF HYDROPONIC FODDER

Hydroponic fodder system does not use electricity. Additionally, we use locally available materials to control the temperature and humidity of the room. By the use of photo-chemically treated trace, we are able to supply an array of hydroponic fodder system which can work under high outside temperature and still not developed fungus and other pathogens. Due to revolutionizing photo-chemically treating trace, fodder system are four times cheaper since there is no need of electricity to cool the system. It is truly a innovative and unique system.

A. Water usage-

The hydroponic system requires less water usage compared to open field farming though it produce high quality stock feed it takes less than one liter of water to cultivate one kilogram of fodder as compared with around 70 liters of water to grow a kilogram of green grass [2].

B. Better growth rate-

Plants are placed in ideal condition, while nutrients are provided at sufficient amount and come into direct contact with roots. Therefore plants do not waste valuable energy. We can get the feed in small lifespan that is around 7 days [3].

C. Land usage-

This type of fodder production provides large economical advantages for example research shows that fodder grown in 9m X 6m can feed daily, the same amount of cattle that graze on 100acres of land. We can generate high yield in small area.

D. Constant food supply-

Using this type of fodder production we can get production for 365 days irrespective of rain and sunshine. It can be used as a method to achieve sustainable livestock feed supply throughout the year. It contains the superior nutrition and hydration compared to other feeds grown in open fields.

E. No weeds-

If we grow weeds in soil we will come across weeds. Weeds are mostly associated with the soil, in hydroponics we don't use soil so there is no bother regarding weed.

F. Reduces labor requirement-

In this type of growing fodder for cattle does not need much man power as in open field cultivation. Man power depends on the size of the shed in use. Research says that 1hour per day is needed to maintain and produce hydroponic fodders.

G. Cost effective-

Production of hydroponic fodder is extremely cost effective and financially viable. A system measuring 4m X 3m X 3m can produce 170 kg of hydroponic fodder. This results in feed in 14 cattle.

H. Nutritional value-

Hydroponic fodder is highly effective particularly nutritious feed, it contains maximum protein energy and is very rich in protein such as b-carotene. Nutrients are conserved in the tank, so there is no losses of nutrients like there in the soil.

DISADVANTAGES OF HYDROPONIC FODDER

- It requires high initial capital investment.
- The feed cannot be stored for longer time.
- Humid and moist environment must be maintained all time, if we failed to do so it causes mold fungi and bacteria to develop.
- Water based micro-organisms can be easily introduced.

III. IMPLEMENTATION OF HYDROPONIC FODDER

A. Hydroponic housing unit-

It is a custom build structure whose role is to provide temperature controlled environment for growing fodder. It is build using hydroponic cloth, timber and has a concrete floor. Inside the house in, there is shelving upon which the trace on which the fodder is grown are placed. Locally available materials can be used in the place of timber reduce cost.

B. Photo-chemical hydroponic trays-

They are the photo-chemically treated trays to prevent fungus on which the fodder is grown.



Fig3.1- Hydroponic Fodder Trays

C. Seeds-

The best seed for hydroponic fodder is barley. Barley is recommended green for hydroponic production because it is

rich in vitamins, minerals, enzymes and growth factors. It is 80% to 85% digestible. It contains high moisture which helps to prevent occurrence of colic. However, other cereals like wheat, sorghum can also be used.

D. Hydroponic nutrients solution-

They are specially formulated liquid mineral nutrients required for the growth of the fodder. They help in making fodder more nutritious. The minerals enhance crude protein content and dry matter lose resulting from depletion of food reserves with in the seed during the germination process, hence increases the final weight of the hydroponic fodder. Different type of grain contain varying levels of crude proteins and yield differently.

E. Water-

We need reliable source of clean water for the fodder. We do not require much water to implement this system.

To prepare the hydroponic fodder we need only a small shed, water, trays and seeds. First we put a seeds on the tray and covered it for two days. After two days the seeds gets sprout. For every 1 hour we sprinkle the water to the seeds after 7 days we get a green grass about 7 inches long which is rich in vitamins and minerals. If we put 1kgs of seeds in the first day we get 8-10kgs of green grass in the seventh day. We need 10kgs of food for one cow per day. In this hydroponic fodder we saves 50% on the animal food and keeps animals healthy compared to seeds grown in open field.

F. Procedure steps-

Seeds are cleaned thoroughly and soaked in 10% limestone solution for 12 hours.

Day 0- Keep the soaked seeds in a jute bag for 12 hours to start germination.

Day 1- Spread the grains on a hydroponic growth tray (1kg per 1 x 2 feet).

Day 2- Day 7- Daily monitor trays for any unwanted growth of mold of fungus.

Day 7- Harvest the fodder mats and feed it directly to animals along with roots.

SURVEY TABLE REGARDING HYDROPONIC FODDER

3m x 3m	Trays	fodder per day	357litres of water	day 119 pigs 79 sheep and goats 2,760 Birds per day
5m x 6m x 3m	180 trays	350kgs per day	350 x 1.5 = 525litres	25 cows per day 175 pigs 167 sheep and goats 4,140 Birds per day
7m x 5m x 3m	230 Trays	448kgs per day	527litres	32 cows per day 224 pigs 240 sheep and goats 5,290 Birds per day
8m x 10m x 3m	600 Trays	1190kgs per day	1785litres	85 cows per day 595 pigs 396 sheep and goats 13,800 Birds per day
10m x 12m x 3m	750 Trays	1,498kgs per day	2247litres	107 cows per day 749 pigs 499 sheep and goats 17,250 Birds per day
10m x 18m x 3m	1,150 Trays	2296kgs per day	3444litres	1150 Cows per day 1198 Pigs 765 Sheep and Goats 26,450 birds per day
10m x 22m x 3m	1,600 Trays	3192kgs per day	4788litres	228 cows per day 1596 pigs 1064 Sheep and Goats 36,800 birds per day

Fig3.2- Survey Table

Dairy cattle need a very well balanced diet of both roughage and protein especially critical during lactation when they lose body weight. An average healthy cow will need to eat constantly for 4½ hours each day. And 100 cows would require an enormous hydroponic system with a constant growth for the needed forage.

IV. COST ESTIMATION

According to survey table we could analyze that if a farmer consists of 10 cows or 70 pigs or 79 sheep he needs 140 kg of fodder for each day and he needs 210 liters of water, if a

Size	No of Trays	Production Capacity	Water Usage (L)	No of Animals Fed
4m x 3m x 3m	70 Trays	140kgs of fodder per day	140 x 1.5 = 210litres	10 cows per day 70 pigs 47 sheep and goats 1,610 Birds per day
5m x	120	238kgs of	238 x 1.5 =	17 cows per

farmer needs to implement hydroponic fodder system it will cost around 25000.

If a farmer has 25 cows or 175 pigs 79 sheep or 4140 birds he requires 350 kg of fodder per day. It requires 5m x 6m x 3m of area and 525 liters of water. It costs around 50000 [4].

If a farmer has 107 cows or 749 pigs or 449 sheep and goats he requires 1498 kg of fodder per day and 750 trays. He also requires 10m x 12m x 3m of area and 2247 liters of water. It costs around 150000.

If a farmer has 1000 cows or 1100 pigs or 750 sheep and goats he requires 2296 kg of fodder per day and 1100 trays. He also requires 10m x 18m x 3m of area and 3400 liters of water. It costs around 1000000.

Generally, the feed cost is about 70-75% of total milk cost where in green fodder contributes 30-35% of total input feed. Rapid urbanization and mining areas has caused shrinkage of grazing area and availability of land at produces green fodder. It is very cleared that with increasing costs and depleting natural resources, sustainable technology like hydroponics would be the key driver of the dairy industry future.

The cost of individual feed items may vary from one region to other region. However, for our understanding we have assumed these costs as cost of green fodder (20kg x Rs30)= Rs600. Cost of dry fodder (20kg x Rs15)= Rs300. Cost of cattle feed/concentrate (9kg x Rs100)= Rs900. Cost of mineral mixture(150g at Rs500/kg)= Rs150. Total daily feeding cost= (600+300+900+150)= Rs1950/day. A cow would generally consume dry matter at 3-4% of its body weight. A 400kg cow will require 12-16kg of dry matter in a day. So from this a 500kg HF cow yielding 20litres per day will require around 20kg of green fodder (may be maize fodder)2kg of dry fodder, 9kg of cattle feed (BIS type 1) and 150g of mineral mixture.

COST REQUIRED FOR THE HYDROPONIC FODDER SYSTEM



Fig4.1- Hydroponic Fodder System

The above diagram shows the basic structure of hydroponic fodder machine. Consisting of trays, sprinklers, channel materials of food grade PVC. By a unit dimension of 4.0*1.2*1.8m (L,W,H) we can get a daily output of 100 kg. It costs around 10000 [5].

SPRINKLING SYSTEM IN HYDROPONOC FODDER SYSTEM



Fig4.2- Sprinkling System

The above figure shows the piping system and the dripping system used in hydroponics fodder system. The cultivation requires continuous water supply so we have used dripper and a timer to supply water. For supply of water we require a electric motor. It costs around 15000 for electric motor, timer and pipe systems [6].

All these basic structures and implementation costs around 25000. Many hydroponic fodder systems require intensive amount of labor, day-in and day-out.

Product description-

- Accurate 180 degree sprinklers that covers exact area of the trays.
- Thread able sprinklers, which can be cleaned and maintained.
- Cost effective solutions for your fodder need.
- Can be fitted both in lateral pipes or UPVC pipes.
- 2 sprinklers per fodder trays [7].

V. OUR IDEAS REGARDING HYDROPONIC FODDER SYSTEM

As we have estimated that for a farmer having 2 cows, he requires around 40 kg of fodder per day. To get this by cultivating in open field it needs for around 2-3 months that could be used as fodder. It also requires more area and fodder will contain less vitamins and minerals as we are not using roots.

To overcome this problem hydroponics was introduced by that we can get a fodder for 7 days. The fodder obtained will be rich in nutrients, vitamins, proteins and minerals and is also a very healthy food for cattle. From this after 7 days we get roots, seeds and grasses are used as fodder.

If a farmer has 2 cows he requires around 40kgs of fodder per day so to get this by hydroponic fodder system, initially the farmer has to invest around 25000. So it is difficult for a single person to invest such a huge amount all at a time.

Small farmers can form a society consisting of similar people with 100 cows together. As our survey table (3.2) shows that to implement fodder system for 100 cows it costs around 300000 and if individual is implementing hydroponic fodder system for 2 cows it costs around 25000. So, if they group around 50 people having 2 cows, it costs around 7000-8000 on each individual. So implementing hydroponic fodder system in this way is more efficient.

Advantages of hydroponics using our idea-

- We could reduce the number of motors that are used so that we can reduce usage of electricity.
- If there is a group or a society means some subsidies will be provided by the government.
- We can appoint a person to look after that hydroponic system so that we can give some work to a person.
- The income obtained by using this method will be more for each farmer.
- The milk obtained by cattle which are feed by this hydroponic fodders will produce organic milk as we have not used any fertilizer to produce fodders.
- The cost of organic milk will be more when compared to milk of cattle which is feed by green grasses grown in open field and the income from hydroponic fodder will also be more. A farmer gets more income in less investment

VI. CONCLUSION

As land prices are growing up, irrigated lands are limited, to meet the dairy animal industry demand for green fodder forces to implement the sustainable method of growing fodder using hydroponic technology. This technology would be back bone for dairy industry in coming days. This technology will provide quality milk products and help our economy.

Barley crop is consider the best choice that can be used for production of hydroponic green fodder with less water consumption.

By implementing hydroponics using our idea we could get more income with less investment that is investment made by a farmer individually will be more when compared with the investment made by a farmer in the society, he could get the same result from the society.

If income of a farmer increases his economical status also increases. By this the economical status of a village also increases and this leads to **rural development**.

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