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Hydroponics as an alternative fodder for sustainable livestock production

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Abstract

Now a days there is rapid decrease in per capita availability of land for cultivation of fodder due to rapid industrialization and urbanization. Which in turn effects the productivity of livestock due unavailability of green fodder which plays major role in production. So there is a need for an alternative for this green fodder is hydroponics. Hydroponics is a method of growing plants without soil by instead using mineral nutrient solutions in a water solvent. Improved space and soil less water conserving methods of fodder production have shown promising results to the farmers especially in the drought prone areas in India.

Keywords: Alternative fodder; Hydroponics; Drought prone areas fodder and Soil less fodder

1. Introduction

Milk production in livestock majorly depends on green fodder, it provides the essential nutrients for maintaining the health and milk production of livestock (Naiket.al 2014). The productive and reproductive efficiency of the livestock is adversely affected due to the unavailability of good quality green fodder. Besides the unavailability of land, more labour requirement for cultivation (sowing, earthing up, weeding, harvesting etc.), more growth time, non-availability of same quality round the year, requirement of manure and fertilizer; the uncertain rain fall, water scarcity and natural calamities due to climate change are the major constraints for green fodder production by the livestock farmers(Mamta. et.al 2016)

The feed cost of milk production is 75 % of total cost where green fodder contributes 30 % value.

In India especially Andhra Pradesh Kadapa district prone for drought condition the annual rainfall is less when compared to other districts in Andhra Pradesh. Due to this the farmers in this area for livestock rearing and milk production they are relaying on concentrates and other sources which in turn increasing the cost of milk production. The non-availability of green fodder, water scarcity and small land holdings of farmers, left so many challenges for maintenance and milk production of livestock (Success story Hydroponic project (2012). Keeping these in view there is a need for alternative fodder for sustainable livestock production round the year (Ankitaet.al 2019). Hydroponics is the solution for this. Because farmers will have total control over a hydroponic system. When compared to traditional soil grown crop Production, hydroponics has the many advantages.

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Definitely hydroponics is a substitute to concentrates and green fodder and it reduces the cost of production and increases the milk production in livestock in drought prone areas and where there is less availability of green fodder.

2. Hydroponics technology

Hydroponic is a method of growing plants without soil by using mineral solution in water and can be efficiently used to take pressure off the land to grow green fodder for the livestock. In conventional cultivation for the growth of plants they need water, nutrients from soil 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 the plants. Fodder produced from hydroponics consists of grass with grains, roots, stem and leaves where as in conventional method of fodder they have only leaves and stem.

3. Farmers can have total control over a hydroponic system

They are able to manage pH and nutrients to make sure plants are getting the exact nutrients they need. The systems are closed and recycles the water that is not used by plants. The ability to grow indoors allows farmers to control temperatures and lighting schedules to improve plant production. Systems can be designed to make use of vertical space and increase planting density. Hydroponics also allow us to create farms in locations where soil conditions are too poor to support farming, or space is limited and a farm otherwise couldn't exist (Maha Rana *et.al* 2011).

4. Hydroponics is an innovative technology for Dairy framers and small land holding farmers

Green fodder will grow at a wider temperature (15° - 32 °C) and humidity (70 -80%) range without any fungal growth. Environmental friendly in nature, Contamination free fodder, Saves water and labour, Fodder grown is highly palatable and nutritious, Fodder improves animal health and reproductive efficiency and production.

5. Comparison to traditional soil grown crop production, hydroponics and the advantages of hydroponics

5.1. Saving water in fodder production

Up to 90% more efficient use of water. Hydroponics require 2-3 liters of water to produce 1kg of green fodder when compared to 60-75 liters to conventional fodder production.

5.2. Less space requirement for fodder production

Production increases 3 to 10 times in the same amount of space. Hydroponics geen house requires marginal land to erect the system of 10 meters X 5 meters land for 640 kg green fodder / day/ unit in comparison to 1 hectare land for conventional fodder growing.

5.3. Less labour requirement and less time of their working hours

Hydroponic system requires less labour work say 2-3 hours / day where as conventional fodder production requires whole day to harvest the fodder.

5.4. Less growing time for fodder production

Hydroponic system requires just 1 week (7 days) to get nutritious fodder from seed germination to fully grown plant of 30 cm height. Biomass conversion ratio is as high as 8-9 times to traditional fodder grown for 60-75 days.

5.5. Growing fodder throughout the year

Irrespective of climatic conditions and other restrictions, fodder for livestock can be grown all-round the year to meet the demand and supply.

5.6. High nutrients

Hydroponic system facilitates the growth of highly nutritious fodder as compared to conventional fodder production. This is very much required for production and reproduction of livestock.

5.7. Controlled environment conditions in the hands of farmers

Indoor farming in a climate controlled environment means farms can exist in places where weather and soil conditions are not favorable for traditional food production.

5.8. Natural feed for livestock

No chemical weed or pest control products are needed when operating a hydroponic system. Hence it is free from contamination of milk and milk related products.

5.9. Less wastage of fodder

Every part of fodder (stems, leaves and roots) can be utilized by livestock without wasting in hydroponics, where as in conventional fodder production there is a wastage of stems and roots.

6. Set up for hydroponic system

It is a simple procedure for growing green fodder. The process consists of soaking of seeds in water and nutrient solution for few days and leaving it for seed germination under controlled environment (providing sunlight / temperature and moisture).

6.1. Components of Hydroponic system

Hydroponic plastic trays, rack or stand to keep trays, water sprinkling set up, green house shade cloth.

7. Setting up of a hydroponic fodder system for livestock

Select the site / land where we want to setup hydroponic system based on quantity of fodder requirement. After selecting the land, it's time for giving it a greenhouse shape and green house shade cloth is needed for fencing the area. The system setup requires a rack to keep fodder trays and automated water sprinklers which can be used for sprinkling water on trays frequently maintain the temperature for faster or fodder seeds. Use wooden or bamboo racks to minimize the cost.

8. Hydroponic fodder and steps involved

Step 1 # Day 1 select quality grains / seeds for hydroponic green fodder. You can select maize, wheat, rice, oats, barley, corn. Take 1 kg seeds and divide it in two parts. Half kg of seeds in each tray and clean the grains from dead seeds or broken seeds. Grains should be washed with the solution of sodium hypochlorite and leave the grains for half hour (30 minutes) in the solution. After draining the grains, soak them in fresh water for a whole day (24 hours).

Step 2 # Day 2 Soaked seeds should be drained properly and left them for 5 hours in open air before placing in the tray and keep the tray in the rack for 2 (48 hours) to allow the germination process.

Step 3 # Day 3 After seed germination, frequent water sprinkling is required for growth of fodder and proper sunlight / temperature should be maintained .you can leave the sprouted seeds in the tray for 5 to 6 days and provide regular and frequent water sprinkling. Once fodder reaches certain height, you can take it directly from the tray and feed the entire plant to livestock. Feed the hydroponics with the roots initially livestock not shows interest to take the fodder combine that with other fodder until the livestock habituated to hydroponic fodder.

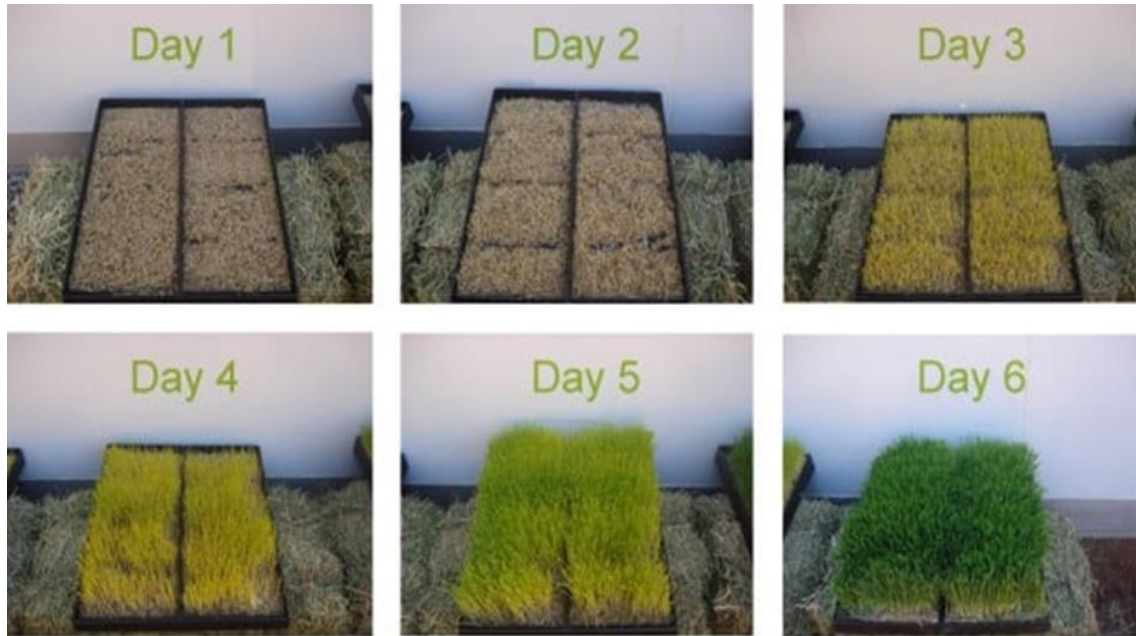


Figure 1 Day wise growth of Hydroponic fodder Production



Figure 2 Hydroponic fodder with roots

Table 1 Hydroponic fodder nutrient comparison with conventionally grown fodder

Nutrients	Conventional green fodder (Maize)	Hydroponic green fodder (Maize)
Protein	10.69	13.59
Ether Extract	2.28	3.53
Crude Fibre	25.97	14.14
Nitrogen Free Extract	51.79	66.78
Total Ash	9.39	3.89
Acid Insoluble Ash	1.42	0.35



Figure 3 A and B Low cost hydroponic fodder production at home with locally available materials and minimal watering without using sprinklers

The method is cheap 1kg of maize seeds produces approximately 8-10 kgs of green fodder, with minimal watering. If we train more number of farmers those not have access to green fodder and land on hydroponics with minimal cost method with locally available materials that will be very much beneficial for them in improving the productivity of livestock and livelihood security of the farmers.

9. Conclusion

Hydroponics fodder is nutritious, palatable and digestible and can be grown in low cost devices with locally available materials and home grown grains. Against impending climate change, hydroponics fodder production is an effective alternative technology for sustainable livestock production in different regions of India.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors declaring that there is no conflict of interest to declare.

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