



**Biotica  
Research  
Today**  
Vol 4:6  
2022

493  
496

## Hydroponics: Power of Water to Grow Fodder for Livestock Production

R. Sathya Priya\*, N. Jagathjothi and P. Murali Arthanari

Dept. of Agronomy, Directorate of Crop Management, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu (641 003), India

 Open Access

### Corresponding Author

R. Sathya Priya  
e-mail: [sathyapriyaagri@gmail.com](mailto:sathyapriyaagri@gmail.com)

### Keywords

Green fodder, High conception, Save water, Weight gain

### Article History

Received on: 21<sup>st</sup> June 2022

Revised on: 28<sup>th</sup> June 2022

Accepted on: 29<sup>th</sup> June 2022

E-mail: [bioticapublications@gmail.com](mailto:bioticapublications@gmail.com)

### How to cite this article?

Priya *et al.*, 2022. Hydroponics: Power of Water to Grow Fodder for Livestock Production. *Biotica Research Today* 4(6):493-496.

### Abstract

Green fodder is the natural diet for livestock. Its production to meet the current demand has become a greatest challenge among livestock farmers. As the gap between the demand and supply of the green fodder for livestock becoming unconquerable, researchers and farmers are in search for an alternative fodder or fodder production method, that would restore fodder and livestock production. Hydroponics is the state of the art technology that has revolutionised the green fodder production in the 21<sup>st</sup> century. Hydroponics is a method of growing green fodder without soil in an environmentally controlled houses or machines. Many of the livestock farmers are switching to hydroponic fodder production from conventional production methods, as the fodder produced by this method are highly nutritious, provide sustainable fodder production round the year and conserve water.

### Introduction

In India more than 70% peoples are earning from agriculture and animal husbandry as agriculture provides a livelihood. Livestock contributes 16% to the total income of small farm households as against an average of 14% for all rural households. It also provides employment to about 8.8% of the population in India. India has vast livestock resources and livestock sector contributes 4.11% GDP and 25.6% of total agriculture GDP. India is first in milk production and our milk productivity (1,538 kg year<sup>-1</sup>) is very low as compared to world average (2,238 kg year<sup>-1</sup>). The major reason for lower productivity is lack of sufficient feed and fodder resources. At present the country is facing severe deficit in feed and fodder with 11.24% shortage in green fodder, 23.4% in dry-crop residues. The stagnation in cultivated area under fodder crops from decades onwards is culprit for massive fodder deficiency. At present, India faces a net deficit of 35.6% green fodder, 10.95% dry crop residues and 44% concentrate feed ingredients and the demand for green and dry fodder will reach to 1012 and 631 million tonnes by the year 2050 (Table 1). A stagnant figure of nearly 5% (8.6 m ha) of the total cropped area in the country is under forages which is facing challenge from sectors like commercially important crops and industries and urbanization, for want of additional lands.

Moreover, fodder crops in India, generally receives less attention and priority over the other food and cash crops. Consequent to this, balance nutrition to animals becomes strenuous owing to lack of green fodder based balance feeding. This alarming trend of resource diminution and endangered animal nutrition deserves strategic changes in fodder production system by identifying alternate and resource efficient production system which could enable enough fodder production even under resource deficit and changed climatic conditions also. With this regard, adoption

Table 1: Demand and supply estimates of dry and green forages (million tonnes)

Year	Demand		Supply		Deficit		Deficit %	
	Dry	Green	Dry	Green	Dry	Green	Dry	Green
2010	508.9	816.8	453.2	525.5	55.7	291.3	10.9	35.7
2020	530.5	851.3	467.6	590.4	62.9	260.9	11.9	30.6
2030	568.1	911.6	500.0	687.4	68.1	224.2	12.0	24.6
2040	594.9	954.8	524.4	761.7	70.5	193.1	11.9	20.2
2050	631.0	1012.7	547.7	826.0	83.3	186.7	13.2	18.4

(Source: IGFRI, 2013)

of hydroponic fodder production system could help in quality fodder production under resource deficit condition in cost effective and sustainable manner. Hydroponic fodder production, a system of growing green fodder without soil, with or without nutrient solution under environmentally controlled structures (Naik *et al.*, 2015), could play an important role towards feed security. Besides, independent to soil requirement, the hydroponic fodder production requires only about 3-5% of water as compared to production in field.

## What is Hydroponics?

The word hydroponics has been derived from the Greek word 'water working'. Hydro means 'water' and ponics means 'working' and it is a technology of growing plants without soil, but in water or nutrient rich solution for a short duration in an environmentally controlled houses or machine.

## Why Hydroponic is a Green Fodder?

- *Saves water:* Consumes 98% less water than conventional method and the used water is recycled.
- *Reduced growth time:* Takes only 8 days duration to develop from seed to fodder while it took 45 days for a conventional fodder to grow. Enhanced nutritive value - as the fodder contains the seed along with the fodder, it has higher crude protein content than conventional green fodder.
- *Marginal land usage:* Upto 1,000 kg green fodder can be produced from 480 square feet area daily which is equivalent to conventional fodder (Co4) produced in 25 acres of cultivable land. Use 99% less land than conventional production method.
- *Constant supply:* Fodder can be produced round the year irrespective of the failure of monsoon, land availability, natural calamities, labour shortage. Promotes sustainable agriculture and livestock production.
- *Requires minimal man power and time:* Only 2-3 hours of work daily, doesn't involve technical work. Farmer can do the work without difficulty.
- *Completely natural and organic:* Fodder is grown completely natural without the use of any pesticides.
- *Optimal production cost:* Production cost is optimal

when compared to conventional fodder production. Cost of production is 2.50 INR kg<sup>-1</sup> of hydroponic maize fodder. Hydroponic machine (1,000 kg capacity) consumes only 40 units of current per day.

- *Reduce feed cost:* As the fodder contains more crude protein that conventional fodder it reduces the feed cost spent on the concentrate feed to half.
- *Minimal equipment usage:* Reduce the need for equipment and fuel used to plant, grow, harvest, transport and store feed.
- *Nutritious fodder:* Hydroponic fodder along with seed and root (sprout mat) are highly edible and are rich in protein (10-17%). Ideal nutrients enriched fodder for livestock.

## Hydroponics Green Fodder Production Technologies

Hydroponically grown fodder utilized by chopping and feeding which popularly known as sprouted grains or sprouted fodder and fresh fodder biscuits. Seed is main component and contributes nearly 90% of the overall cost of production in hydroponics technology of fodder production. This technique provides green fodder to animals and increases profit to dairy farmers mainly in the conditions of deficit cultivated land and labour. Fodder grown by this technology is reported to have more nutrition, digestibility and palatability which ultimately enable enhanced milk production, maintaining animal health and reproductive efficiency owing to balance nutrition through balance feeding (Naik *et al.*, 2015). The fodder produce from hydroponic technology can be fed to all the animals such as buffaloes, cows, sheep and goat. The main inputs in this farming technology are the water with added nutrients and sunlight. Compared to conventionally grown fodder where only leaves and stem is part of animal diet, in hydroponics fodder consists of root, stem, leaves and grains. The main benefit of this technology is its suitability to be grown round the year irrespective of their growing seasons which provides regular employment and satisfying returns throughout the year. Several fodder crops such as cowpea, bajra, jowar, maize, sunhemp, ragi, horsegram can be grown hydroponically; however, maize is most preferred

fodder crop in India.

Yield of hydroponically grown fodder maize is reported as 5-6 times than the conventionally grown fodder maize. Fresh biomass yield of hydroponic maize crop has been reported as 1.2 kg ft<sup>-1</sup> of tray area under evaporative cool hydroponic chamber (Singh *et al.*, 2021). It is also profound that, if the regular diet of a cow is supplemented with 5-10 kg of fresh hydroponic fodder in a day, it can increase the milk production (8-13%) owing to enhanced digestibility and conversion efficiency of feed components. Plastic trays with dimensions 18"×32.5"×2" produces about 5.5-7.5 kg of green fodder by using 1.0-1.25 kg seed rate (Ramteke *et al.*, 2019). The produced fodder looks like a mat having a height of 20-30 cm consisting plants' stem, roots, seeds having highly digestible nutrients. The difference between conventional and hydroponics green fodders were given in the table 2.

Table 2: Conventional green fodder vs. Hydroponics green fodder

Parameters	Conventional green fodder (Maize)	Hydroponics green fodder (Maize)
Protein	10.67	13.57
Ether extract	2.27	3.49
Crude fibre	25.92	14.07
Nitrogen free extract	51.78	66.72
Total ash	9.36	3.84
Acid insoluble ash	1.40	0.33

(Source: Naik *et al.*, 2015)

## Yield and Economics of Hydroponically Grown Green Fodder

One tray containing 1.5 kg maize seeds produces 7-9 kg green fodder with fodder height of 20-25 cm with the use of 2-3 litres of water per kg of biomass. Cost of production of hydroponics fodder was given in the table 3.

### Steps for Growing Hydroponic Fodder Maize

- **Soaking of seeds in water:** For proper germination of seed, soaking is required with freshwater for 4-20 hours depending upon the seed coat hardness. The germination is also influenced by the temperature of the water or solution used for soaking.
- **Sprouting of seeds:** The seeds are spread in plastic trays or light weight metallic trays having holes upto 1 cm depth so that the waste solution having nutrients can be collected and recycled.

Table 3: Cost of production of hydroponics fodders in commercial machine

S. No.	Particulars	Amount (Rs.)
1	Cost of maize seed	Rs. 14.50 kg <sup>-1</sup>
2	Current consumption	40 units day <sup>-1</sup>
3	Cost of current for production of 1 tray (7 kg)	Rs. 4.00 unit <sup>-1</sup>
4	Labour cost for production of 1 tray	0.5 units (or) Rs. 2.00 tray <sup>-1</sup>
5	Cost of production of one kg of hydroponic maize fodder	Rs. 2.10 (maize seed cost) + Rs. 0.20 (current bill cost) + Rs. 0.70 (labour cost) = Rs. 3.00 kg <sup>-1</sup> .

• **Traying:** The trays used must be free from any dust or impurities and should be washed by cleaning solution properly. Trays are moved and placed them in sprouted section after seed germination.

• **Regular shifting of trays to next level:** The seed is kept moist by sprinkling water. The trays must be shifted to the next level daily to move it to next step in the growth cycle. Also rotate the trays according to its growth. Load trays on '1<sup>st</sup> two rows' of racks. Next day, shift '1<sup>st</sup> day trays' in '3<sup>rd</sup> and 4<sup>th</sup> rows' of racks. Then, every following day, shift these 'two rows of trays' to their respective below 'two rows' of racks till they reach 'bottom two rows', which coincides on 7<sup>th</sup> day. On 8<sup>th</sup> day, 'bottom two rows of trays' containing optimum grown green fodder are removed for feeding dairy animals.

• **Harvesting:** The fodder mat is ready for harvest after 7-8 days of sowing and can be directly fed to cattle. After harvesting the trays should be properly washed with the help of cleaning solution so it can be reused for the next cycle.

### Does It Enhance Livestock Productivity?

Yes it is. The following are the benefits of feeding hydroponic fodder to livestock.

#### 1. Young ones

- Faster weight gain.
- Good carcass quality.
- Lower feed cost per kg of weight gain.
- Improved health with low veterinary cost.

#### 2. Adults

- Increased fertility (large litters).
- Low feed cost.
- High conception rate.

#### 3. Lactating Animals

- Heavier, longer lactations.

- High milk yield.
- High fat percentage.
- Low feed costs.
- Increase in milk revenue.
- Increased fertility (fewer replacements).
- Improved herd health and longevity.
- Reduced culls.

#### 4. Poultry

- Faster weight gain.
- Good carcass quality.
- Lower feed cost per kg of weight gain.
- Improved health, low veterinary cost.
- More and higher quality eggs.

### SWOT Analysis of Hydroponics System in India

Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis indicates a framework for helping the researchers or planners to identify and prioritize the business goals and to further identify the strategies of achieving them.

#### 1. Strengths

- Hydroponics makes any land with water source useful for fodder production.
- High yields can be obtained from lesser space.
- Due to the premium quality, produce can fetch premium prices.
- Less number of labour is required which means it is a less costly venture.
- Integrated pest and disease management can be done in a very effective way.

#### 2. Weakness

- Till date there is no association or tie up with any industrial regarding selling of the products.
- High initial cost of investment and capital expenditure.
- It needs more diligence and devotion than conventional farming.
- There are no dedicated standards and laws in India till date.

#### 3. Opportunities

- Branding, packing and selling of the hydroponically grown produce can be done in a clean, healthy and unique way.
- More cash crops such as ginger, turmeric and saffron and should be tried to grow hydroponically.
- These crops are gaining good traction in India.
- Hydroponically grown crops can be sold to urban market which fetches high return.

#### 4. Threats

- There must not be any competition regarding price but on quality in between conventionally and hydroponically grown products.
- There is a wrong perception among some people that hydroponically is unnatural.
- Certain soil grown produce are being marketed vigorously and may be a threat to hydroponic produce for e.g., Clayx on tomato.
- Inconsistent supply arrangement may also ruin the market intake.

### Limitations of Hydroponic Fodder Production System

- Requirement of efficient and skilled labour.
- Higher chances to microbial infections in greenhouse conditions.
- Hydroponic fodder often has *Aspergillus clavatus* infection which can cause hypersensitivity, dragging of hind legs, clonic convulsions, tremors, decreased milk yield and possibly death and should not be fed to dairy cattle.

### Conclusion

Hydroponic fodder production system is having potential to overcome green fodder scarcity. There is no doubt that it will play a major role in reducing the green fodder demand and supply gap in our country as well as state. Hydroponically grown fodder is reported to have more nutrition, digestibility and palatability which ultimately enable enhanced milk production, maintaining animal health and reproductive efficiency. It is profound that, if the regular diet of a cow is supplemented with 5-10 kg of fresh hydroponic fodder in a day, it can increase the milk production (8-13%) owing to enhanced digestibility and conversion efficiency of feed components.

### References

- IGFRI, 2013. Vision 2030. Indian Grassland and Fodder research Institute, Jhansi, p. 48.
- Naik, P.K., Swain, B.K., Singh, N.P., 2015. Production and utilisation of hydroponics fodder. *Indian Journal of Animal Nutrition* 32(1), 1-9.
- Ramteke, R., Doneria, R., Gendley, M.K., 2019. Hydroponic Techniques for Fodder Production. *Acta Scientific Nutritional Health* 3(5), 127-132.
- Singh, S.K., Patil, A.K., Kautkar, S., Dwivedi, P.N., Singh, A.K., 2021. Cooling and qualitative study of evaporative cool hydroponically grown maize crop. *Current Journal of Applied Science and Technology* 40(22), 1-7.