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Hydroponic Fodder: A Sustainable Solution to Green Fodder Scarcity in Livestock Farming

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Introduction

Green fodder plays a vital role in livestock nutrition, particularly for dairy animals, by supplying essential nutrients needed for milk production, growth, and reproductive efficiency. Consistent supply of quality green fodder is crucial for maximizing animal productivity and ensuring the sustainability of livestock farming. However, fodder scarcity remains a major constraint in India, despite it being the largest milk producer globally.

Currently, only 4.9% of india's total cultivated land is dedicated to fodder crops, leading to a 35.6% deficit in green fodder, 26% in dry fodder, and 41% in concentrate feed. Several factors contribute to this gap, including urbanization, shrinking landholdings, limited irrigation, deforestation, mining, and lack of awareness or interest in scientific fodder farming. Rising labor costs and fragmented lands make conventional fodder cultivation difficult and economically unviable for small and marginal farmers.

To tackle these challenges, hydroponic fodder production has emerged as a modern, space-saving, and resource-efficient solution. This soil-less technology allows farmers to grow green fodder throughout the year using minimal water, space, and time. it holds promise in addressing the feed deficit, especially in regions with limited arable land or water resources, thereby supporting sustainable livestock development.

Hydroponics Technology

Hydroponics is the science of growing plants in nutrient-rich water instead of soil and is an effective method to reduce pressure on land for green fodder production (Naik et al., 2015). Known as “controlled environment agriculture,” it involves regulating factors like light, humidity, temperature, pH, and nutrient levels.

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This method provides water, nutrients, and sunlight directly, promoting optimal plant growth without soil. Hydroponic fodder includes grains, roots, stems, and leaves, unlike conventional fodder which lacks grains and roots. Crops like maize, barley, oats, and sorghum have been successfully used in this

Table 1. Demand and supply of fodder in india (in million tonnes) over the years and projected demand and supply.

Year	Demand		Supply		Deficit		Deficit as %	
	Green	Dry	Green	Dry	Green	Dry	Green	Dry
1995	947	526	379.3	421	568	105	59.95	19.95
2000	988	549	384.5	428	604	121	61.10	21.93
2005	1,025	569	389.9	443	635	126	61.96	22.08
2010	1,061	589	395.2	451	666	138	62.76	23.46
2015	1,097	609	400.6	466	696	143	63.50	23.56
2020*	1,134	630	405.9	473	728	157	64.21	24.81
2025*	1,170	650	411.3	488	759	162	64.87	24.92

* Figures are projections.
Source: Based on Xth Five-Year Plan Document, Government of india.

system. increasingly, dairy and livestock farmers are adopting hydroponics for its ability to produce highly nutritious fodder year-round while also saving water and ensuring sustainability.

Principles of hydroponic fodder production

Hydroponics is growing of cereal grains with necessary moisture, nutrient and absence of solid growing medium. The sprouted shoot and root mat is harvested and fed to animals. Germination is a response for the supplied moisture and nutrient and produce 200 to 300mm long forage green shoot with interwoven roots within 7 to 10 days. Different cereal grains can be used for fodder production with varied chemical and structural changes throughout the growing processes.

Nutritive value of hydroponic fodders

Hydroponic fodder from cereal grains shows changes in nutrient content during sprouting. As starch decreases, dry matter and organic matter reduce, while ether extract and linoleic acid increase due to plant growth. Crude fiber, NDF, and ADF rise, but nitrogen-free extract drops. Sprouting boosts total ash and mineral content, especially with nutrient solution use. Compared to conventional fodder, hydroponic fodder has higher crude protein, ether extract, and palatability, with minimal nutrient loss since both shoots and roots are consumed. Though energy values like TDN and ME decrease during sprouting, digestibility improves, and animals consume around 25 kg/day effectively.

Figure- Hydroponics tray with fodder and feeding of hydroponic fodder to cattle

Advantages of hydroponics fodder

1. **Conservation of water:**

   it requires only 2 to 3 litres of water to produce one kg of luxuriant green fodder, as compared to 60 to 80 litres of water to conventional system of green fodder production. Water left over in hydroponics is recycled to grow the fodder.

2. **Reduced labour cost and need:**

   in conventional fodder production requires continuous presence of labour from cultivation to harvesting of the grass, but in hydroponics labour required is 2- 3 hours / day only. hence the cost of production of hydroponic fodder is less.

3. **Land requirement for hydroponic technology:**

   Hydroponic fodder production requires minimal land, making it ideal for areas with limited space or where agriculture is challenging. This system allows maximum fodder yield in a small area, benefiting densely populated or arid regions.

4. **Reduction in growth time of green fodder in hydroponic technology:**

   This technology produces green fodder faster than traditional growing methods. To obtain nutritious fodder requires only above 7 days from seed germination to fully grown fodder of 25 –30 cm height. Green fodder won't waste their valuable energy for absorption of diluted nutrients submerged deep within the soil, instead of that they can almost entirely be focused on growing and boosting the production of green fodder.

5. **Minimizing wastage of green fodder:**

   Green fodder produced from hydroponics will be fully utilised as there won't be wastage of the fodder during feeding of animals as compared to wastages of chopped traditional grasses during consumption by the animal.

6. **Natural feed for animals:**

Production of green fodder through hydroponics is completely by natural source. in this technology no herbicide, pesticides are used in green fodder production hence no residues of any chemicals occurred into the milk.

7. **Availability of green fodder round the year:**

This technology is capable to make provision for the green fodder round the year, as per demand of consumption of green fodder of livestock. Constant supply of green succulent fodder can be organised irrespective of season, rain, storm, sunshine (Singh *et al.,*2007). Hydroponic fodders are highly succulent, their intake varied between 15 to 25, 0.25 to 2.0, 1.5 to 2.0 and 0.1 to 0.2 kg/animal/day in large ruminants, small ruminants, adult pigs and rabbits respectively or 1.0 to 1.5% of body.

8. **improvement of milk production in dairy animals:**

Providing regularly lush green fodder to milch animals it can compensate the concentrate feed so as to have economically feasible to the farmers and milk producing industry. There is increment in milk production of 8-13% with the use of hydroponic fodder.

9. **increasing balanced, palatable, nutritive value of fodder:**

through hydroponics technology it is possible to improve the nutritive value by adding additional growth promoters, nutrients to

Conclusion

Green fodder is an important constituent in the feed of livestock. Due to many drastic changes in agriculture system, animal rearing and increased population there is shortage of green fodder to the livestock. Green fodder production through hydroponics technology can be a real beneficial alternative source to overcome the fodder deficiency in livestock sector with many advantages.

References

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