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Nutritional Benefit and Economic Value of Hydroponics Fodder Production Technology in Sustainable Livestock Production Against Climate Change - A Mini-Review

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Abstract: In many parts of the world, production of sufficient green fodder and grain to feed the livestock population has become a big challenge. This is due to limited land allocation, fertilizer and manure requirements for cultivation, lack of irrigation facilities and natural calamity. To overcome this problem, hydroponics fodder production technology is an emerging as alternative to grow sufficient quality fodder and some parts of concentrate in livestock farms. Hydroponic fodder production is a method of fodder production, in which fodder seeds are germinated into a high quality, highly nutritious, disease free animal food in a hygienic environment. It is also more palatable and digestible and can be grown in low cost devices with locally home grown grains. Moreover, it is advantageous in terms of nutritional benefit and economic value, constant food supply year-round, marginal land use, reduced labour requirement and natural feed for animals. However, there is a big gap and no adequate compiled information that clearly indicates the importance of hydroponics fodder production for sustainable livestock production against climate change. Therefore, it is important to review the aspect thoroughly and bring minor details into focus to have better understanding of hydroponics fodder production for sustainable livestock production against climate change.

Keywords: Hydroponic Technology, Livestock Production, Nutritional Benefit

1. Introduction

Even though fodder production and livestock feeding are the two important aspects for the sustainability of products and productivity in animal husbandry [1], feed scarcity had been the major limiting factor in improving the livestock productivity. In many parts of the world, the production of sufficient conventional green fodder and grain to feed the huge livestock population has become a big challenge. This is due to limited land allocation, resources, labour requirement, fertilizer and manure requirements for cultivation, and lack of irrigation facilities, prevailing water scarcity and natural calamity (frequent draught) [2-3]. Fodder shortages are continuously hindering the sustainable livestock production resulted in poor productive and reproductive performance of the animals. To overcome this problem, hydroponics fodder production technology is an emerging as alternative to grow not only sufficient quality fodder but also some parts of concentrate in livestock farms.

Hydroponic fodder which globally, is considered to be the best livestock feed replaces grains like dairy meal; pig's feeds and poultry feed concentrates which are very expensive. However, there is a big gap and no adequate compiled information that clearly indicates the importance of hydroponics fodder production for sustainable livestock production against climate change. Therefore, it is important to review the aspect thoroughly and bring minor details into focus to have better understanding of hydroponics fodder production for sustainable livestock production against climate change.

2. Concept of Hydroponics Fodder Production Technology

The word hydroponics has been derived from the Greek word 'water working'. Hydro means 'water' and ponic means 'working' and it is the science of growing plants without soil, but in water or nutrient rich solution.

Hydroponic fodder production is a method of fodder production, in which fodder seeds are germinated into a high quality, highly nutritious, disease free animal food in a hygienic environment [4-5]. Hydroponic cultivation is an eco-friendly method of growing fodder and hydroponically grown cereals grow up to 50% faster and produce higher yields of better quality fodder [6].It takes place in an intensive hydroponic growing unit in which only water and nutrients are used to produce nutrient rich grass and root combination [7]. It is highly water efficient and reduces water waste and essential natural and man-made resources required to grow fodder while controlling the effects of climate and growing conditions [8].

Hydroponic methods have been used for a long time to grow plants, primarily vegetables, but hydroponics is now being used across many countries to take pressure off the land, shortage of water, erratic rainfall and frequent draught grow green feed for livestock, poultry and carp raised for agriculture.

3. Importance of Hydroponics Technology

Even though the cost of production may vary with the production capacity of the machine and various fixed and variable expenditures incurred in the production of hydroponics fodder, a lot of advantages are also associated with hydroponics green fodder as it is a viable alternative technology for the farmers having no grazing lands, lack of irrigation facilities and water scarcity.

Nutritional Benefit and Economic Value

Different types of fodder crops viz. barley, oats, wheat, sorghum, alfalfa, cowpea and maize [8] can be produced by hydroponics technology. It has also been recognized as a viable method of producing vegetables and ornamental crops such as herbs, roses, freesia and foliage plants. Hydroponics fodder is more palatable, digestible and nutritious while imparting other health benefits to the animals [9]. Feeding of hydroponic maize and barley fodder to growing goats increased total dry matter intake, per cent feed conversion efficiency, total body weight gain and economically valid [10]. Growing of hydroponic maize fodder proved improved nutrient content with less water, less space used and cost effective [6].

Hydroponic maize fodder in pig nutrition improved performance and nutrient digestibility of weaned pigs. There hydroponically produced fodder has been used to feed swine, reducing death rates and improving the general health of the animals, while reducing feed expenses [11].Thus, there is great potential for developing hydroponic technology for fodder production in pig farming [12].

Hydroponics fodder cultivation is very easy and simple science of growing fodder crops in less time, water and input cost. The hydroponic green fodder produced from this innovative system has a high nutritional potential and value. These feeds are suitable for use at all types and categories of animals - cows, sheep, goats, pigs, horses, rabbits, fish - and birds [13]. Besides, there is no need of costly soil preparation for fodder production, constant weed removal, fencing etc. Besides, there is no need of fuel for harvesting and post harvesting processes and no damage from insects or roaming animals, etc. leading to low maintenance requirement [14].

3.1. Constant Food Supply

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. Farmers using this type of fodder production are guaranteed a consistent supply of quality fodder 365 days of the year irrespective of rain, hail, sunshine or snow [15, 9]. 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 farm, which are free from antibiotics, hormones, pesticides, or herbicides [14].Having this constant food supply also allows farmers to retain their stock, selling them when the prices are suitable without having to accept poor market prices because of lesser quality livestock.

3.2. Marginal Land Use

This type of fodder production provides huge ecological and economical advantages, as the production of this lush fodder requires minimal land usage as compared to field-grown grasses and feeds. For example research shows that fodder grown in a 9m x 6m shed can feed (supplement) daily, the same amount of cattle that graze on 1200 acres of pastured in rangeland [16]. Hydroponics green house requires marginal land to erect the system, i.e., 10 mts x 4.5 mts land for 600 kg green fodder / day/ unit, in comparison to one hectare land for conventional green grass field. Reduction in the amt of land required for maximum fodder production is an asset for both regions where agriculture is difficult and densely populated areas that lacks sufficient growing space [17].

3.3. Reduced Labour Requirement

Hydroponic process of growing cattle fodder requires minimal man-hours per day. Depending on the size of the shed in use, research has shown that as little as 1 hour per day is needed to maintain and produce hydroponic fodder. As compared to the many hours of intense labour required growing the same amount of feed as a pasture crop. More time will be required however depending on the distances being travelled to feed the hydroponic fodder to livestock [18].

3.4. Natural Feed for Animals

Growing of green fodder through Hydroponics is completely by natural source. No pesticides are used in green fodder production that could contaminate milk and milk products. Green fodder produced from hydroponics will be fully utilized as there won't 'be loss of the fodder during feeding as compared to wastages of chopped traditional grasses during consumption by the animal. By providing green fodder to milch animals it can compensate the concentrate feed so as to have economically viable milk producing industry.

4. Conclusion and Recommendations

Hydroponic fodder system has the potential to allow farmers to yield a fodder that has the ability to supply huge ecological and economical merits. This is because the diminution in the amount of land needed for greatest livestock production verifying to be imperative benefit for both regions where agriculture is difficult and due to densely populated land is scarce for growing different types of animal fodder. Hydroponics fodder is nutritious, palatable and digestible and can be grown in low cost devices with locally home grown grains. Against impeding climate change, hydroponics fodder production is an effective alternative technology for sustainable livestock production in different regions of the world. Therefore, governmental and nongovernmental organization should give emphasis for effective utilization and advancement of hydroponics fodder technology. Formal training should be given for the livestock producers to increase widely used of this technology. Besides, mechanisms should be devised to increase the involvement of stakeholders in the activities of hydroponic fodder production in any pats of the world without limited to agro-ecology.

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