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# Efficacy of greenhouse system for the hydroponic fodder production: A Review

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## Abstract

Livestock requires year-round fodder supply for their proper growth and milking. However, in conventional agriculture fodder is only available during short span of growing season. Growing fodder in hydroponics by using re-circulating nutrient solution and drip irrigation without soil in controlled environment is an innovative idea for year round production especially during slack period when it is not available for livestock. It is a water conservative technique, have various advantages over conventional growing methods. It minimizes water wastage by using drip irrigation system and nutrient film technique. The problems of water damage the quality of fodder. Hydroponically grown fodders are usually diseases and pesticides free. Greenhouse ideal environment increases efficiency of fodder production as compared to conventional farming. Animal's production is severely affected by scarcity of quality food. The cost of production included, system establishment costs, cost of water gadgets, nutrients, cost of environmental control devices, seed, electricity and labors cost etc. are essential for a successful hydroponics fodder growing system. Feeding of hydroponically grown fresh fodder to animals result in increase of meat and milk production, and increase overall performance of animals. Quality of soilless green fodder is prominently depends on the management of hydroponic system. Many kinds of fodder crops i.e. barley, oats, wheat, sorghum, alfalfa, cowpea and maize can be grown in soilless culture. This paper, highlighted different work conducted on fodder production under greenhouse condition. Additionally, the present work highlighted potential impact of year round fodder production on food, agriculture, socio-economic conditions and livelihood of farmers.

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**Introduction**

Fodder is an animal's feed that is specifically used to feed livestock's i.e. goats, cows, rabbits and buffalo's. In Pakistan year round fodder is not available especially during slack period of winter (November-December) and summer (May-June). Farmers demands for year-round fodder production system. Only hydroponic system fulfills the required need of the farmers. In Pakistan, a unit of hydroponic farming was initiated near Rawalpindi by Bio-Blitz Company of Holland in 2006.

The group of Dutch growers and engineers handed over the unit to PMAS- Arid Agriculture University, Rawalpindi. In 2009, this unit of five greenhouses produced horticultural crops of tomatoes, cherry, eggplants, lettuce, capsicum and cucumber etc. Local farmers showed a keen interest in raising hydroponic fodder. In this paper, we highlighted different work conducted on fodder production under greenhouse condition all over the world. Additionally, the present work will highlight potential impact of year round fodder production on food, agriculture, socio-economic conditions and on livelihood of farmers.

*Soilless fodder*

The production of fodder under protected environment give the highest values of chemical examination and physical features and compared to the production of fodder under control cooling room. The financial aspect is measured when comparing the high cost of control cooling room and energy needs with the greenhouse.

There were some opinions about the growth of seeds for suitability of fresh silage production in soilless structure to satisfy the resources of feed for animals (Tudor *et al.*, 2003).

It is essential to work on green fodder to get increased production for animals. The shortage of animal green fodder has been recognized as key issue for the improvement of livestock. Low milk yield and meat of the animals due to the low quality feed having shortages in protein, carbohydrates, vitamins and minerals. 80% area from cultivable land is utilized for grain production, where 0.10% of area used for the production of fodder. Thus, green fodder deficiency is increasing abruptly and now it has showed up as a severe issue for animals (BBS, 2015).

Sterilization is an extensive process for protected environment but it is actually essential for plants as system must be free from any germs before the sowing of any new plants. Steaming is the best strategy for sterilization. However, it is expensive because of the expense of work and energy. Using of chemicals is another technique for sterilization. It is not so costly as compared with steam sterilization; there are some disadvantages of chemical sterilization (Cooper, 1996).

Application of methyl bromide and formaldehyde are extremely toxic and cause chemical residues on crop and pollution of environment. In hydroponics system, sterilization is not needed for the substrates and resources used as they are just utilized for once. So, in hydroponics sterilization is not needed by utilizing materials just for once (Runia, 1994).

Output of hydroponic system may vary according to countries mainly depends on the prices of materials and services. In protected environment, establishment costs, cost of water gadgets, cost of environmental control devices and control is essential for a successful hydroponics system (Olympios, 1955).

In recent years hydroponic systems started to be automated. Nowadays commercial solutions do exist, even open source solutions such as the Hydroponic Automation Platform (HAPI). Small and medium size soilless automated systems for fodder production that can operate in small areas and have a six days timeline for production, does not exist. The fodder is produced in trays that are placed in a six storeys mechanical structure, to ensure different conditions for fodder development at each day. In each storey are placed fodder trays that will be moved from the lower storey to the upper storey. In the lower storey are placed the seeds that will grow while the trays are elevated at the end of each day, to the next storey. At the end of the sixth day, the fodder is then placed in the conveyor to feed the animals in the agricultural holding.

After unloading the tray, it is pushed to the first level for washing, and the next six days cycle then starts, to produce new trays full of fodder (HAPI, Hydroponic Automation Platform, 2015).

Danger of disease is a lot higher in soil. Soil with its defence ability can reduced any error from the grower associated with nutrients arrangement, but a little mistake in the arrangement of nutrients water and pH proved to be dangerous to plants in hydroponics. Failure of water supply or power supply can cause damage in a little time. Hydroponics is not a simple procedure. Experienced staffs are needed for management. Hydroponics system management should be able to set and control electrical devices, modify and arrange the nutrients water, to have knowledge composition of nutrients water and have an option to control plant diseases (Olympios, 1955).

*Advantages of Hydroponics Fodder*

Serving of soilless fresh fodder to animals cause rise in milk production of 8% and 9% (FCM yield). The farmers of the Satara district of Maharashtra exposed that there was rise in the milk yield about 0.5-3 liters per day per animals and net income by Rs. 30-50/- per animal per day because of the serving of soilless fodder to their animals. Besides, there were increase in fat, improvement in conception rate and health of the dairy animals, decrease cows food requirement about 25%, whiter milk, improve the taste of milk, reduction in labour cost, freshness of the hydroponics fodder, requirement of less water and space (Reddy *et al.*, 1988). There is reduction in the dry weight and increase in fresh weight during sprouting of seeds. One kilogram seed give about 6 kg green fodder and 11-14% dry matter. But, occasionally dry matter content reached to the range of 18%. Global trend in animal production shows that a quick and huge increase in the consumption of livestock products. There are great increase in demand for milk meat, eggs and fish. (Naik *et al.*, 2013).

Fodder greenhouse consist of two parts – a production zone where the soilless system has installed and the fodder is grown along with irrigation and drainage systems exists and where pumps, nutrient tanks, and associated systems are located and grain is prepared for sowing (Carruthers, 2003). Many kinds of fodder crops i.e. barley, oats, wheat; sorghum, alfalfa, cowpea and maize can be grown by soilless technique. But, the selection of the hydroponics fodder depends on the agro-climatic and environmental circumstances and accessibility of seeds. The variety of grain selected for growing of hydroponics green fodder because of its lower cost, quick growing habit, availability and good biomass production. The grain should be fresh, sound, unspoiled or free from disease, natural, feasible and good quality for healthier biomass production (Naik *et al.*, 2012). Generally-closed re-circulating soilless culture, can use up to 40% less nutrients water than static system, but are not easily monitored and sustained. This trouble rises from ion concentration when the nutrient water recirculating (Christie, 2014).

The maximum length of channels (pipes or trays) should be 15-20m. In channels (Pipes or trays), longer length could limit the height, slope of the pipes or trays generally a drop of 1 in 50 to 1 in 75. Very Long channels having unwanted slope, can cause issues of poor water aeration (Graves, 1983).

Re-circulating soilless system do not limit crop production or quality of crop. But, a feature restrict the wide growth re-circulating system in substrate culture is the concentration of salt ions in re-circulating nutrients water. Re-cycling process makes from the bay of salt particles and water at higher convergences of the water system water than the relating particle to-water take-up proportions (Sonneveld, 2002).

Inadequate green fodder is a major contributor to the poor performance of the livestock due to the low production. Additionally, the demand for forages is higher due to limiting of high yielding livestock breeds. Fodder availability needs if livestock is sustained in the farm. Efficient planning of feed and fodder resources required to be joined for sustaining of the livestock and the income of majority small dairy farmers (Biradar & Kumar, 2013).

Al-Karaki & Al-Hashimi (2012) found the two advantages of the hydroponics growing system are first it possibly produce much higher yields and the secondly it is used in areas where conventional agriculture is not possible. Many of the livestock farmers are moving to hydroponic green fodder production from traditional growing techniques, because the fodder produced by hydroponics methods are extremely healthful, provide green fodder production round the year and save water.

Sinsinwar & Teja (2012) reported that in hydroponics plants are grown in water and mineral rich solution. This method can be used for dairy feeds production. In hydroponics fodder production, the fodder produced can be up to ten times higher compared to conventional fodder and less space is needed. Water use efficiency of more than 80% is achieved in hydroponics fodder production compared to growing fodder in the soil. An experiment reported that 1.5 litres of water was needed to produce 1 kilogramme of hydroponics fodder.

Livestock production and reproduction are adversely effected by the scarcity of good quality of green fodder. More growth period, requirement of fertilizer, unavailability of good quality fodder round the year, water scarcity, the uncertain rain fall and natural calamities due to climate change are the key constraints for hydroponics fodder production by the farmers. Because of the mentioned de-merits of the traditional technique of fodder production, soilless culture is a best option to grow fodder to encounter the needs of farm animals (Naik *et al.*, 2011).

Seeds soaking process and the quick rise of water for metabolism for growth of the plants is a main stage for growing of hydroponics green fodder. In case of grass seeds, soaking in water for 4 hours is useful. In field agriculture, farmers growing hydroponics fodder by placing the seeds in a bag and and keep for 1-2 days after wetting the seeds (Naik *et al.*, 2012).

The basic principal for hydroponic fodder production is that cereal grains responds to moisture and nutrient solution for germination and growth of seeds and produce green plants in short period. Nutrient water include important nutrients i.e. potassium, nitrogen, calcium, phosphorus, sulphur, magnesium etc. The green sprouts and roots of grass are collected and served to animals. Various cereals can be used as animal feed, including barley, oats, wheat, corn and sorghum (Dung *et al.*, 2010).

Sneath & McIntosh (2003) indicated that quality of hydroponics green fodder is greatly depends on the management of hydroponic system. Some of the best practices that must be observed in the hydroponics fodder production are; use of clean planting materials, pH and temperature in the greenhouse. Mould growth is a major challenge in hydroponics fodder production and it negatively affects the fodder and livestock health. The mould growth can be minimised by use of clean planting materials, maintaining the correct moisture, PH and temperature in the greenhouse and disinfecting the pipes and trays using chlorine solution.

The fodder mat ranges up to 20cm high where growing level is 9 kilogram of green silage equal to about 1kg of dry weight (Bustos *et al.*, 2000).

Producing green fodder in hydroponic system increases water use efficiency when as compare to conventional production of green fodders. "The hydroponic system requires a fraction of water compared to conventional farming while still supplying high quality stock feed" (Mooney, 2002).

Hydroponic fodder is more profitable in economic point of view to many farmers because of its great production, and control of diseases and infections. The conventional fodder sometimes causes infections to the animals. The grain sprouting percentage in soilless culture is around 98%. Hydroponic fodder can be stored up to 10 days. Hydroponic green fodder system can deliver sufficient green yield to fulfil the nutrition requirements of the animals (UNB, 2017). Fodders grown by soilless culture is more healthful than fodder grown in soil, rich in nutrients, minerals and germ-free. Milk production is increases up to 15% (Pramanik, 2017).

In conventional fodder production, 1 unit of fodder needs 80 units of water while in a hydroponics system 1.5 units of water are used to produce 1 unit of fodder. Additionally water from the hydroponics system can be collected and recycled for other farm uses (Bill & Pavel, 2002). Grain is drowned in a soaking tank containing nutrient water for a day before sowing. The soaking supports with the metabolism of reserve material and these reserve material used for the development and growth of fodder (Sneath & Mclntosh, 2003). Sneath & McIntosh (2003) reported that there is incompatible indication that sprouting increases or decreases DM digestibility as compare to the fresh grain. This evaluation give some simple process of grain. For improving the utilization of seeds, treatment is needed for increasing digestibility. If grains are not treated, its means that only 60% of the starch is processed.

The quantity of seeds, which varies with the type of seeds, also affects the production of the fodder. The recommended seeding rate for production of hydroponic wheat fodder is 4-6kg/m$^2$ and for maize fodder is 6.4-7.6kg/m$^2$ respectively. The seed cost indicated 90% of the all-out cost of growing of hydroponic fodder (Al-Karaki & AlMomani, 2011)

Joseph Mooney (2002) observed that growing of fodder in soil-less culture which is nutrients rich has been proved to be both financially and environmentally friendly. He concluded that the technology is a great asset for highly populated regions where growing space is a problem and where agriculture is difficult. The technology also allows farmers to have 100% control of the fodder production throughout the year; this avoids effects of the weather such as hails or shine that could destroy the fodder. They are able to get both quality and quantity in the fodder in turn will translate to good productivity of livestock.

By providing the optimal environment the efficiency of fodder production is increased remarkably. Hydroponic systems minimize water wastage since it is give directly to the roots and is often re-circulated and used several times. However, the solution should be fresh because fungi and bacteria increase during re-circulating. It is, therefore, suggested to go for filtering of the water before using (FAO, 2015).

Dung *et al.* (2010) reported about digestibility of sprouted fodder. They found the loss of dry matter and no change in digestibility. They reported that the early deterioration of the shoots was greater as compare to the broken grain. Hydroponic systems require much less space and time than conventional systems, which makes the former ideal for urban dwellers with limited yard space. The plant root systems of hydroponic fodder are much smaller than in a traditionally grown fodder, which means higher numbers of plants per unit of space. Crop rotation is not necessary in hydroponics, the same fodder species can be grown throughout the year. Using soilless system, about 600-1000 kg fodder can be grow (Naik & Singh, 2013).

Sneath & McIntosh (2003) also found that there are many claims related to the production of hydroponics fodder. Up to 10 time the fresh weight of hydroponics fodder collected as compare to the weight of seed. The wet weight does not give a precise degree of the feed value of the fodder. The calculation the dry matter yield is necessary to get an accurate measurement of feed value. Dry Matter contents depends on the weight of leaves from a weight of seeds and the dry matter% of the leaves.

Dung *et al.*, (2010) states that the animals like green, leafy and stem less food with leaves having intermediate tensile strength. A major variance was in the digestibility of the root zone versus shoot zone of the hydroponics fodder. DM gives a detailed information about the capacity of growing fodder to generate food, there is a complete investigation of the food that offers greatest particular study of the value of green fodder as compare to the other fodder. Treated seeds and sprouts are digestible and healthy feeds (Sneath & Mclntosh, 2003).

Islam *et al.*, (2016) describes the effect of seed amount and nutrients composition on production of hydroponic fodder and describes that high nutritive value and production performances can be achieved by using two seeds to grow hydroponic fodder in greenhouse condition.

The cost of hydroponics green fodder is depends on the seed, electricity and labour. Seed cost alone about 25% of the total price of production. It is reported that in the hydroponics green fodder production unit of 600kg daily production, approximately 1500-1600 liters of water (if water is not re-circulated) and about 15-16 units of electricity are utilized. It is worth mentioning here that if the seeds are produced by farmers, the cost of growing of the soilless fodder will be decreased significantly (Naik *et al.*, 2012).

Dung *et al.*, (2010) reported that vitality rate of shoots was less than the grain on a dry matter and 2% energy loss observed after relating the shoots with the seeds. It is observed that there was no major change in the loss of total dry matter and digestibility without a major development in digestibility, which shows significant reduction in the overall digestible energy.

Soilless fodder is rich in enzymes usually alkaline, so, serving of the soilless culture fodder increases the productivity of animals by rising a strong immune system by neutralization of the acidic situations. Moreover the reduction of the anti-nutritional features, soilless fodder is a main cause of chlorophyll and hold a juice that increases the efficiency of the animals (Shipard, 2005). Mohsen *et al.*, (2015) also reported that the inclusion of soilless fodder at 30% in the food of rabbits has good effect on the body weight. Moreover, 50% restoration of concentrate mixture with soilless fodder significantly ($p < 0.01$) reduced the feed conversion ratio (3.61+0.15) and cost of feeding/animal/30 days (IR: 35.25+0.39) comparable to concentrate fed group (5.32+0.21 and IR: 39+0.58). Thus, feeding of hydroponic fodder not only influences the growth of rabbit but also considerably reduces the economics of feeding.

Starova Jeton (2016) describes that the process of soilless fodder comprises fresh and untreated seeds of high quality. Temperature of the water or solution used for soaking also affects the germination rate. Quantity of seeds varies with the type of seeds, also affects the yield of the fodder. Heins *et al.* (2015) reported that the hydroponic fodder need low electricity requirement as compare to the traditional fodder production. Amongst different hydroponic fodders such as sprouted barley, oats, rye, triticale, and wheat, the sprouted barley has the highest forage quality. Many livestock farmers are moved to soilless fodder technique from traditional fodder growing techniques, because of hydroponic fodder are highly nutritious. There is an excessive benefit offered by soilless fodder to increase performance of animals. Many kinds of fodder crops i.e. barley, oats, wheat, sorghum, alfalfa, cowpea and maize can be grown by soilless culture.

But, the selection of the soilless fodder depend on the climatic and geographical circumstances and availability of seeds (Snow *et al.*, 2008). Yvonne Kamanga (2016) describes that hydroponic fodder has been produced in a simple greenhouse containing wooden frame shelving on which trays containing seeds are stacked.

The growth of wheat fodder in one week caused 17% loss of dry matter while Yocum (1925) as mentioned by Chavan and Kadam (1989) detected 25% reduction in dry matter of wheat grains after two weeks (Chavan and Kadam 1989).

Naik and Singh (2013) found that hydroponic systems require much less space and time than conventional systems. The root length of plant of hydroponic fodder is much smaller than in a traditionally grown fodder, which means higher numbers of plants per unit of space. It is also easy to start a hydroponic system indoors. Crop rotation is not necessary in hydroponics, the same fodder species can be grown throughout the year. A study revealed that only one square meter space is required to produce fodder for two cows per day and the milk yield was increased by 13%.

Al-Karaki (2011) found that 7–10 days required for the growth of hydroponic fodder and not require high space, but less space is required for the production of hydroponic fodder.

Soilless fodder rich in proteins, high quality, full of vitamins and minerals. These superior characteristics soilless system, make it a very useful agricultural system for fresh fodder.

Soilless culture is a technique to grow crops without using soil. Crops are grown in water and mineral rich water. This technology can be used as an alternative for dairy foods production in case of less space, size and also during the dry seasons. In hydroponics fodder production, the fodder produced can be up to ten times higher compared to conventional fodder and less space is needed because the fodder is grown in pipes and trays which are arranged inside the hydroponics system. Water use efficiency of more than 80% is achieved in hydroponics fodder production compared to growing fodder in the soil (Sinsinwar & Teja, 2012).

Starova Jeton (2016) researched that hydroponic fodder is highly succulent, its 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 weight. Fresh green fodder is the natural food for animals. The production of fresh green fodder has become a greatest challenge among farmers.

Saidi & Abo Omar (2015) reported that hydroponic fodders are highly digestible, palatable and relished by the animals. Feeding vitamin-rich hydroponic green barley fodder did not increase bioavailability of nutrients for fattening calves. There was no effect of the fodder on average daily gain (ADG), but feed cost was increased by 24%.

Although green fodder is the most important factor for the development of livestock region, growth of this region is not reached the required level of attention in the past. It is reported that fodder and feed contributes about 70% of total price in livestock production. The data of fodder production vary in different countries. Fodder production operation depend on the climate, economic conditions, crop growing pattern and type of livestock (Anonymous, 2015).

Rachel Jemimah *et al.*, (2015) found no adverse effects on ADG and feed conversion ratio (FCR) in goat kids and rabbit kittens fed hydroponic horse gram or sun hemp fodder replacing 50% of a concentrate mixture.

This review, will discuss research findings on soilless culture systems. The discussion topics will focus on soilless substrate particle size, fertigation solution salinity, nutrient content and pH, product quality and plant and microorganism interaction. Additionally, we will discuss the use of precision agriculture in soilless culture systems performance (Schwarz *et al*, 2009).

Mysaa Ata (2016) reported that 90-day feeding trial on 3-month-old weaned Awassi ram lambs showed that feeding hydroponic fodder improved ($P<0.05$) ) feed intake, ADG and FCR significantly compare to those fed a ration containing barley grains.

Lorenz (1980) announced that development of seeds is a fundamental driver of improved compound activity, lost dry issue, and high pace of all out protein, change the piece of amino corrosive, a decrease in starch, rises sugars, a minor increment in unrefined fiber and rough fat, and marginally more prominent amounts of minerals and nutrients. Chung *et al.* (1989) reported that fibre contents increases up to 6% in un-sprouted seeds in 5th day of shoots.

The variety and growing circumstances greatly influences on the structure of the fodder at any specific period of growth, so fodder from different soilless greenhouses differ in structure even if picked at the same time (Cuddeford 1989).

Naik *et al.*, (2014) describes that significant increases in the digestibility of nutrients in lactating cows fed hydroponic fodder compared to those fed Napier bajra (NB-21) green fodder. Feeding of hydroponic fodder for 68 days to lactating dairy cows did not have any significant effect on digestibility of nutrients, except that the digestibility of CF and NFE was higher ($P<0.05$) in the HMF fed group. The daily milk yield was 8.0-14.0% higher in animals fed TMR containing hydroponic fodder than those fed conventional green fodder.

By growing barley using hydroponics, it is advantageous and more applicable in small-scale farming. There are problems of enough land and the alternative cost of feed is quite high. It is also worth noting that there is a significant decrease in dry matter as the barley sprout grows as compared to the barley seeds. The digestibility of barley as a fodder increases as the sprouting time increases. Hydroponic fodder production perform in an controlled structure in which only nutrients rich water are used to produce nutrient rich fodder and root combination (Peer & Leeson, 1985). Naik *et al.* (2017) found that feeding of hydroponic fodder by replacing 50% grains in the concentrate mixture is not any adverse effect on nutrient utilization and efficiency of low yielding lactating cows. Besides increased milk yield, conception rate, herd health and longevity were also improved. Furthermore, it must follow that improved animal health stemming from higher quality hydroponic fodder will reduce veterinary costs.

Mincera *et al.*, (2009) reported that the addition of soilless fodder in the animals food is not change the haematological and biochemical limitations, but resulted in development in the animal safety and production of milk. Marisco *et al.*, (2009) completed a comparable investigation for goats so found no variety in hematological and biochemical parameters. Additionally in the sheep case, didn't watched any variety in milk creation between sheep benefited from soilless feed and sheep bolstered ordinary feed.

McKenzie *et al.*, (2004) found that hydroponic fodder heavily infested with Aspergillus clavatus should not be fed to dairy/beef cattle. Putnam *et al.*, (2013) reported that sprouting resulted in 7-47% loss in dry matter after one week of growth, generally due to respiration in the growth procedure. Enzymes are activated when seeds are soaking then gives off water and carbon dioxide, resulted in the loss of DM.

Tranel (2013) found that traditional fodder production requires a major investment for the purchase of land, in addition to investment in agricultural machinery, equipment, infrastructure required for pre- and post-harvesting, including handling, transportation and conservation of fodder. It also requires labour, fuel, lubricants, fertilizers, insecticides, pesticides, and weedicides. On the other hand, hydroponic fodder production requires only seed and water as production inputs with modest labour inputs. Hydroponics minimises post-harvest losses, with no fuel required for harvesting and post harvesting processes. Heins *et al.*, (2015) reported that low amount of electricity needs for the production of hydroponic fodder.

Naik and Singh (2013) found that root length of hydroponic fodder is much smaller than in a traditionally grown fodder, which means higher numbers of plants per unit of space. Fazaeli *et al.*, (2012) stated that comparative evaluation of hydroponic fodder produced by using tap water or nutrient solution revealed that growing of sprouts by nutrient solution had high value of crude protein and ash contents as compare to the sprouts grown by tap water. The Ca, K, P, Mg, Na, Fe, Cu and Zn concentrations were greater in hydroponics fodder produced using nutrient solution.

The unavailability of quality green fodder adversely affect the efficiency of the livestock. Besides the less availability of land, required more labour for operation, more time for harvesting, un-availability of similar quality around the year, requirement of fertilizer; the uncertainty of rain fall, water scarcity and natural calamities due to climate change are the main limitations for green fodder production encountered by the farmers. Due to the limitations in the soil, soilless technique is a modern technology for growing fresh grass for animals (Naik *et al.*, 2011). Morgan *et al.*, (1992) stated that small variation in dry matter when fodder was supplied with 1000 lux from day 2, 4, 6 or 8. Fodder provide with light from day 8 showed unpleasantly yellow color while the peak level of light caused a decrease in fodder height, generally due to decreased colourlessness. Two days lighting need to green the grass.

Morgan *et al.*, (1992) stated that the protein elements and ash of shoots enlarged from 4$^{th}$ day with the enlargement of the roots allows nutrients uptake.

Fazaeli *et al.*, (2011) stated that no major variation was found in weight gain or feed effectiveness between a control food and fodder food, containing of hydroponics grain. Tudor *et al.*, (2003) found that steers increased with soilless grass did well than expected period of time. Islam *et al.*, (2013) played out an examination for cost examination of growing of fodder in assigned regions of Bangladesh and expressed that the BCR was the greatest (2.18) in Jashore locale and the lowermost (2.18) in Kurigram region for grub maker cum merchant.

Naik *et al.*, (2013) reported about cheap devices for soilless production of fodder and exposed that soilless grass can be grow in cheap green houses. Dry matter is lost because of the metabolic action of budding of seeds during germination (Chavan & Kadam, 1989).

Soil or clay has poor water retaining ability makes it most suitable for re-circulating soilless system. The failure of water pump can lead to the damage of plant in couple of hours, particularly in warm climate. Aeration is greater in the systems because the oxygen exhausted air is ejected each time. The nutrient rich water should be aerated to rise its oxygen level is sufficient (Jensen *et al.*, 1998).

Generally hydroponics a technique of growing crops without using soil. The nutrients rich water is used for irrigation. Fodder crops produced by soilless method are also called hydroponics fodder or sometimes called sprouted fodder. The hydroponics green fodder (wheat) is have high germination rate and fast growing habit generally seven days. Fresh fodder extremely high in protein and energy. So that, hydroponics fodder is highly palatable, disease free and highly nutritious for animal food for all classes of livestock (Sneath & McIntosh, 2003).

Dung *et al.*, (2010) stated that protein is a major element in the progress and efficiency of animal and has a key role in investigating the feed value of fodder. Some experiment shows increases in protein, and some shows decreases in protein. Dung *et al.*, (2010) also reported that important minerals were greater in combination on the basis of dry matter in the shoots. This shows an advantage to the fodder. The vitamins are usually enhanced by germination. This will make little variation in the feed rate, but also stated that the rises in separate vitamins are so lesser that its importance to meet the nutritious needs of foods is hard to estimate in feeding trials (Sneath & Mclntosh, 2003).

Many experiments have been completed to evaluate the livestock performance on sprouts. These experiments included the efficiency of pigs and poultry, dairy cattle and beef cattle. In the comprehensive review of soilless fodder related to the beef cattle that many of experiments on animal's efficiency from soilless shoots revealed no benefit in the diet, particularly if it changes highly nutritional feeds like grain (Sneath & Mclntosh, 2003).

Finney (1982) reported that recent research revealed that increase in animal performance on soilless fodder and juice factor. Hydroponic fodder is a main source of nutrients leads to enhanced animal performance while some researches has revealed that there is no enhancement in animal performance with hydroponic sprouts. The suddenly rise in the livestock population with the severe rearing structure resulted in the increase demands of fodder in the country. The feed shortage has been the main restrictive feature in increasing the animal's productivity (Brithal & Jha, 2005). Soilless fodder production is a method to grow fodder i.e. wheat, barley, cowpea, maize and sorghum etc. to grow with high quality, extremely nutritious, disease free food, free of fungicides, insecticides, herbicides, and artificial growth agents. Soilless fodder needs 7-10 days for growth in a small piece of land for production. Hydroponic agriculture is an environment friendly technique for the production fresh green fodder and grow faster due to its fast growing habit and give high yields and better quality. Soilless fodder is a technique of fodder production, in which seeds are developed into pipes or trays without soil in protected environment (Jensen & Malter, 1995).

Chavan & Kadam (1989) stated that an increase or decrease in protein take place while a many experiments showed non-significant variation because of the developing leaves. The rise in protein content leading to the loss of dry weight.

## Conclusion

Output of hydroponic system may vary according to the area mainly depends on the prices of materials and services. The unavailability of quality green fodder adversely affect the efficiency of the livestock. Hydroponics fodder is highly water conservative technique and decreases essential natural and artificial resources required for the growing of hydroponics fodder.

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