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POSSIBILITIES OF HYDROPONIC CEREAL PRODUCTION IN UZBEK AGRICULTURE

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ABSTRACT
In recent years, hydroponic fodder production in controlled environment (CE) settings has received an increased amount of attention. This is mostly because to the scarcity of agricultural land for food production as well as the detrimental effects of climate change. On the other hand, the most significant challenges for the continuation of fodder production in the CE are the problems with dry matter and the expenses of operations. This research presents a complete literature analysis on methods and control strategies for indoor settings and watering that are presently utilized and might be adopted in the future to accomplish the economic and environmental sustainability of controlled environment fodder production. These techniques and control strategies are already being used to achieve the goal of sustainable controlled environment fodder production (CEFP). According to the current studies, the production of fodder using a hydroponic system is gaining popularity in industrialized nations, although the use of low-tech systems such as greenhouses is more common in underdeveloped countries. The development of hydroponically grown plants may be employed in agriculture to increase the economic viability, environmental friendliness, and ecological integrity of farming. The tests carried out on Asr wheat and Zamin wheat by means of the hydroponic plant technology, which is utilized to provide fodder for the local cattle. We compare the traditional cow feeding way and the hydroponic plant of cereal way. And the local cattle farmers' receptivity to growing cereal crops in hydroponic systems.

KEY WORDS
Hydroponic, fodder production, technology, cereal crop.

With the growing population, climate change, global warming, and high technology development, it is urgent to pay attention to sustainable agriculture to feed the growing population with proper food. Cereals are a complex procedure as the vital element of human and livestock' food diet. Hydroponic plant production as new and advanced technology has a win-win effect in both environmentally friendly and economic benefits. It will be worthwhile to study hydroponic cereal, which will be used to feed livestock in the future. Despite a rising global population and the need for extra land for agriculture, the amount of cropland in

Europe has decreased since 1950, and reforestation has even occurred in certain places of Europe (Dao et al. 2015).

The many potential benefits of hydroponics are the reason it is being researched. These benefits include the ability to grow plants anywhere without the need to prepare the soil, a faster rate of plant development, a lower prevalence of plant disease, and the ability to reuse the water used in the growing process. It can generate throughout the year (Barbosa et al., 2015) to help feed the world while reducing waste, increasing efficiency, and improving the environment. Numerous theoretical and experimental studies have looked at the energy requirements, production yields, land requirements, water demands, and costs of hydroponics, often comparing them to those of more conventional farming methods. The use of hydroponic systems for the production of fodder might help conserve a large quantity of water and decrease dependence on conventional methods of crop production. According to the findings of certain research, the same quantity of fodder may be produced utilizing 0.5% of the available growing land at a cost that is 35-45% cheaper (Adebiyi, 2018). When compared to production in open fields, hydroponic systems may save up to 95% of the water that would have been used (Deng et al., 2013). Additionally, the nutritional contents of hydroponic fodder, including protein, vitamins, enzymes, and minerals, are much superior to those of grounded or open-field systems (Shipard, 2005, FAO, 2009, Fazaeli et al., 2012). Consumer demand is therefore affected by harvest yields, seasonality, management, expense, and upkeep (Baker and Ako, 2009). Hydroponic farming costs are high (Bright Farms Inc., 2013).

In comparison to traditional farming, hydroponic farming may take twice as many inputs to yield the same amount of crop. Hydroponic farming's main benefit is eliminating the need for soil (Circle A Farms, 2013), while nutritionists argue about whether agricultural method is healthier. Hydroponic fodders are grown in hydroponic systems. Antibiotics, hormones, pesticides and herbicides are not used in the cultivation of this produce (Naik, 2014, Naik et al., 2015).

MATERIAL AND METHODS OF RESEARCH

Our research war carried out in Uzbekistan. Farmers often use maize seeds for growing feed in hydroponic systems. If you live in a cold area, you can grow wheat and oats in a hydroponic fodder system, whereas if you live in a hot climate, you can grow maize. Special care is required to establish a hydroponic system.

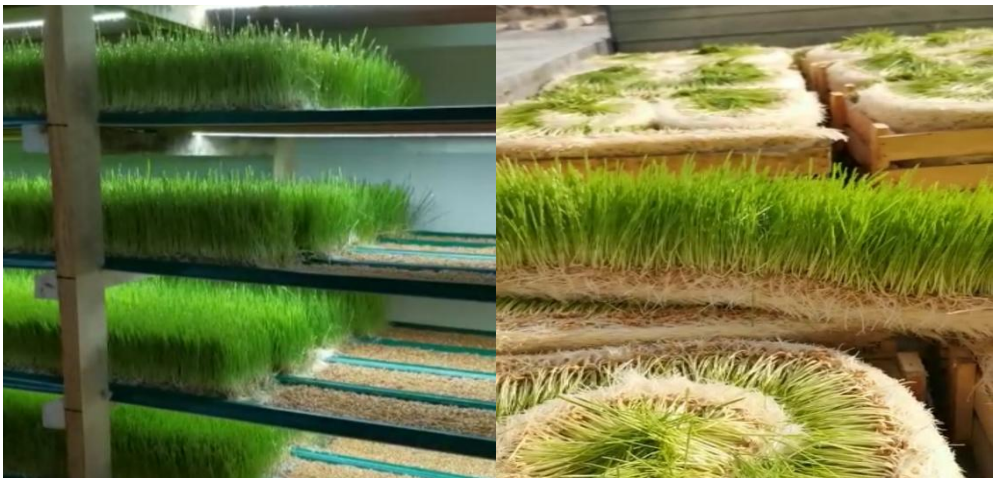

Figure 1 – We used dry wood for the construction and that helped a lot in preventing fungus growth. Mature wheat plants ready for packing

Stands made up of wood are made up of dry wood (Figure 1) with strong legs so that they can support heavy weight without fungal growth. Proper lighting is another crucial factor and in this experiment we used light bulbs at proper distance. But lighting was started from

3rd day after sowing the wheat seeds. The hydroponic system includes an angle iron frame, growth troughs, aeration, lighting, cooling, irrigation, supernatant collection, and control devices. The frame is the primary component of the hydroponic system. Artificial lights were used for growth. Throughout the whole of the trial, temperature was 18-20 °C. If it goes above 24 °C, fungus appears on that white root system. There was special room where we kept the temperature stable. The size of room was 11.6 m and ceiling height was 5.7 meter. There are a total of twelve plant-growth trays, and these trays were distributed among the three NFT (nutrition film technique) units in such a way that there were two trays for each NFT unit on each of the two floors that were vertically separated.

It is possible to considerably enhance the efficiency of the method of generating fodder by ensuring that the proper environment is maintained throughout the operation. The water is not only delivered to the plant's roots, but it is also often recycled and used several times, which helps hydroponic systems drastically cut down on the amount of water that is wasted. On the other hand, since recycling occurs during the course of the growth cycle, the water should be free of bacteria and fungus because of the increase in their numbers.

RESULTS OF THE STUDY

Dairy production may benefit greatly from hydroponic technology. This is so that any location may produce fodder utilising hydroponic technology, provided that technological advancements remove conventional limitations. Adopting this method will make it simple to produce fresh fodder from grains like wheat, barley, and oats. Therefore, the quality of dairy feeds, their nutritional value, the health of dairy animals, and the production of meat and milk may greatly benefit from this kind of fodder production. Among dairy producers, hydroponic technology is a key economic and revenue-generating factor. Fodder produced hydroponically has a brief growth cycle (about 7–10 days) and needs a modest amount of land. Animal health benefits from its excellent feed quality, which is abundant in proteins, vitamins, and minerals. Due to this, several nations today employ hydroponic culture as one of the most significant agricultural methods for producing green fodder.

Table 1 – Cost Table

SN	Particulars	No. of materials	Rate (USD/unit)	Total cost USD
1	Lubi Motor	1	36.22	36.22
2	U-pvc pipe 42mm	35m	6.16	215.5
3	U-pvc pipes 32mm	7m	4.83	33.80
4	U-pvc pipes 25mm	6m	4.23	25.35
5	Regulator Valve	2	1.21	2.41
6	Flow Control Valve 16mm	5	0.6	3.02
7	Pvc Pipes 25mm	2m	1.33	2.66
8	Tea 38mm	100	0.60	6.36
9	Tea 25mm	60	0.6	36.22
10	Tea 20mm	35	0.48	16.90
11	Elbow	4	.60	2.41
12	End cap	4	0.19	0.77
13	Jet Sprinklers	50	0.12	6.04
14	Timer	1	18.11	18.11
15	Disc Filter	1	24.15	24.15
16	Automization system to measured temp., humidity and light intensity	1	84.50	84.50
17	Total			514.42

Source: Tayade et al., 2018.

The greater moisture content and lack of dust in fodder produced hydroponically lower the risk of respiratory illness and aid in its treatment. Producing fresh green feeds requires extremely little water. It does not lead to soil erosion or overuse of fertilisers, eliminating the need for herbicides, pesticides, or other synthetic fertilisers. With locally sourced or homegrown grains, hydroponically produced fodder may be cultivated in inexpensive greenhouses. A high-tech greenhouse system takes around 1 to 3 litres of water (7 days) to create 1 kg of fresh hydroponically grown wheat feed. Many farmers said that fresh yield might increase by 8–10 times. If the seed was produced at home, the cost of producing hydroponic fodder was around Rs. 2-3/Kg fresh fodder; however, if the seed was bought

from the market, the cost of production was somewhat higher at Rs. 0.036- 0.042 $ (Tayade et al., 2018).

CONCLUSION

In recent years, soilless agriculture has grown in significance as a potentially successful method for growing a variety of crops. This pattern is anticipated to persist. In comparison to conventional approaches, this one enables the year-round cultivation of perishable commodities like vegetables and feed on very less area with a reduced labour need. Growing food hydroponically has the potential to expand food production options, particularly in regions with little soil or water resources. The sector needs to witness the advent of low-cost hydroponic technologies that lower labour costs and total operating costs via increased degrees of automation in order to continue this expansion.

On the other hand, there are challenges that must be overcome, including the potential for diseases to spread quickly within closed systems, such as fungal growth, and contradictions, such as the need for fossil fuel supply. As long as sustainability is constrained by the need for fossil fuels, substantial building structures, technical equipment, disinfectants, and waste materials, the use of hydroponic techniques should always be carefully evaluated in terms of environmental balance and long-term effects on both the health of the planet and our health. This is due to how limited sustainability is as a result of these needs. The results of this research suggest that feeding fodder to animals raised in a hydroponic system is advantageous for both animal health and the economics. The water-rich feed enhances animal appetite and may be used commercially in the future in Central Asia.

REFERENCES

1. Adebiyi, O. A (2018). Effects of feeding hydroponics maize fodder on performance and nutrient digestibility of weaned pigs. Applied Ecology and Environmental Research, 16(3), 2415–2422. https://doi.org/10.15666/aeer/1603_24152422.
2. Baker, A., Ako, H (2009). Small-scale lettuce production with hydroponics or aquaponics.
3. Barbosa, G. L., Gadelha, F. D., Kublik, N., Proctor, A., Reichelm, L., Weissinger, E., Wohlleb, G. M., & Halden, R. U (2015). Comparison of land, water, and energy requirements of lettuce grown using hydroponic vs. conventional agricultural methods. International journal of environmental research and public health, vol. 12(6), pp. 6879–6891. https://doi.org/10.3390/ijerph120606879.
4. Bright Farms Inc (2013). Hydroponic farming. https://www.brightfarms.com.
5. Circle A Farms (2013). Hydroponic lettuce. https://www.circlealettuce.com.
6. Dao H., Friot D., Peduzzi P, Chatenoux, B., De Bono, A. & Schwarzer, S (2015). Environmental limits and Swiss footprints based on Planetary Boundaries. UNEP/GRID-Geneva & University of Geneva, Geneva, Switzerland.
7. Deng, F., Wang, L., Liu, L., Liu, D.-Y., Ren, W.-J., & Yang, W.-Y (2013). Effects of Cultivation Methods on Dry Matter Production and Yield of Rice under Different Ecological Conditions. Acta Agronomica Sinica, 38(10), 1930–1942.
8. FAO (2009). Global agriculture towards 2050. https://www.fao.org/.
9. Fazaeli, H., Golmoihammadi, H.A., Tabatabayee, S.N. and Asghari-Tabrizi, M. 2012. Productivity and nutritive value of barley green fodder yield in hydroponic system. World Applied Sciences Journal, 16: 531-539.
10. Naik, P.K. 2014. Hydroponics green fodder for dairy animals. In: Recent Advances in Animal Nutrition (Eds. Bakshi, M.P.S. and wadhwa, M.). Pp 191-210. Satish Serial Publishing House, New Delhi.
11. Naik, P.K., Swain, B.K. and Singh, N.P. 2015. Production and utilisation of hydroponics fodder. Indian Journal of Animal Nutrition, 2015. 32: 1-9.
12. Shipard, I. 2005. How can I grow and use sprouts as living food. Stewart Publishing.
13. Tayade, R. G., Gupta, S. V., Patil, B. N., & Deshmukh, M. M (2018). Cost of hydroponically grown fodder in hydroponic structure. Int. J. of Agriculture Sci., 10(15).