POTENTIAL OF HYDROPONICS IN INDIA

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ABSTRACT

More than half of India's workforce is still comprised of individuals who work in agriculture or closely related sectors. However, agriculture's share of India's GDP has been falling for some time. In this note, I will discuss the recent advances in hydroponics research and technology, and how they might help Indian farmers increase their crop productivity and revenue by replacing the inefficiencies of traditional farming with a more sustainable and profitable alternative. This advanced innovation is gaining traction in the Indian market, and with good reason. Its primary audience is found in the IT startup community located in urban areas.

Keywords *Hydroponics, potential, Startup, innovation, traditional, Farming*

INTRODUCTION

Gardening without the need of soil, or hydroponics, has a long history. Hydroponic technologies are used by millions of people today for both small-scale and industrial-scale crop production. It's hard to imagine, but just around 0.1% of farms worldwide are thought to employ hydroponic systems as their principal growth method. Please be aware that there are a wide variety of hydroponic systems and methods. In reality, there are more than fifty distinct approaches to hydroponics. Indoor plant cultivation is the focus of controlled environment agriculture, often known as climate- and weather-proof farming or indoor vertical farming. Hydroponic farming, a relatively recent discovery, simplifies the growing process even further by removing all of the extraneous components of conventional farming, despite the fact that indoor farming is not a new occurrence (greenhouses have been used for centuries). One of the primary causes of the decreasing availability of arable land in India is the country's rapidly increasing population. Providing for a rapidly expanding population as arable land decreases is a pressing problem. India's shortage of farmland may be solved in the future by using hydroponic farming techniques. More food staples might be grown, and farmers would need less water and soil to do it.

LITERATURE REVIEW

Shailesh Solanki et.al (2017) In hydroponics, mineral nutrient solutions are used to grow plants without soil. The term "hydroponics" comes from the Greek word "hydro" for water and "ponos" for labor. It's also known as "Agriculture in a controlled environment" (CEA). There has been a recent uptick in the study and commercialization of hydroponics. For rapidly reproducing horticultural crops including strawberries, lettuce, tomatoes, and carnations, this method has been effectively used in several countries. Hydroponic plant systems need just a minimal number of inorganic components in addition to water, oxygen, and sunlight, as was determined by researchers

using this method of water culture to produce plants. Growing crops without soil throughout the year with hydroponics might be a huge boon to India's agricultural sector. Indian farmers may benefit greatly from these methods since they allow them to maximize agricultural yields on even the smallest, most fragmented of farmland plots. This analysis looks at the difficulties and opportunities of implementing soil-less farming in India, with the hope that it would help Indian farmers produce organic, toxic-free, high-quality crops at a lower cost.

Anil Kumar et.al (2020) Maximizing food production per unit area, often known as productivity, is essential due to the ever-increasing human population. Aquaponics, nutrient film technique (NFT), aeroponics, etc. are all well-known advanced techniques, however they don't make efficient use of land. For this reason, vertical farming was developed as a compromise solution to the land scarcity issue. It makes use of vertical space that would otherwise be wasted in conventional agricultural methods. Because of this, it may also be easier for consumers to get freshly cut veggies on a daily basis. Because of their high nutritional worth, salad veggies are also a great choice for the growing number of health-conscious individuals who are prioritizing their diets. There are many positive health effects from eating veggies. They contain a plethora of nutrients crucial to human health and development, including minerals, vitamins, and bioflavonoids. Raw vegetable salads are another option. Vegetables are another good fit for this framework because of their short growing seasons and large net returns. Using a variety of growing substrates, such as perlite, coco-peat, vermiculite, etc., you can cultivate these for rapid growth and abundant harvests.

Francesco Ruscioet.al (2019) This study describes the creation of an inexpensive farm monitoring system that can keep tabs on a hydroponic urban vertical farm, allowing for the farm's full automation and a rigorous quantitative analysis of its output. In the last decade, energy-efficient and inexpensive LED lights have sparked a resurgence of interest in urban farming; however, the optimal configuration of such systems (i.e., amount of nutrients, light-on time, ambient temperature, etc.) is largely based on the farmers' experience and empirical guidelines. Moreover, even if simple, the maintenance of such systems is labor consuming since it needs water to be topped-up frequently, mixing of the nutrients etc. To unleash the full potential of urban farming, a quantitative knowledge of the function that each variable plays in the development of the plants is required, combined with a greater degree of automation. This research proposes a low-cost monitoring system to help close this knowledge and technology gap by automatically collecting sensor data such water and air temperatures, water levels, humidity, pressure, light intensity, pH, and electric conductivity. The suggested platform is modular, so more sensors and actuators may be added with little effort. Using a simple online interface, data may be accessed from anywhere. It is possible to utilize the suggested platform to automate some of the most time-consuming farm maintenance tasks in addition to doing quantitative optimization of the farm setup. It is possible that, provided sufficient data are obtained, a monitoring system of this kind may be utilized for strategic decision making.

Antonio Fernandes Monteiro Filho et.al (2018) The use of mineral solutions in hydroponic culture is common, but the use of organo-mineral solutions is not as well understood. The purpose of this study was to compare the yields of three green-leaf lettuce genotypes (Thas, Vanda, and

Verônica) grown in an NFT hydroponic system installed in gutters using eight different fertilizer solutions. This study compared four mineral solutions by naming them after their authors: Bernardes, Furlani, Castellane and Arajo, and Ueda. In addition, four organo-mineral solutions were treated (with biofertilizers included in their composition). The experiment included three repetitions and was conducted using randomized blocks of split plots. In the primary plots, eight nutrient solutions were used, and in the secondary plots, three lettuce varieties were planted (including six plants per subplot). We measured lettuce growth by its shoot fresh phytomass (SFP), root fresh phytomass (RFP), shoot dry phytomass (SDP), and root dry phytomass (RDP) at 25 days post-transplant (RDP). The researched parameters did not have an interaction impact on the production variables. Root fresh phytomass was the only production measure that varied across lettuce varieties, and that was solely because of differences in the nutrient solutions. The mineral solutions of Bernardes, Furlani, and Castellane and Arajo resulted in greater lettuce yield for commercial purposes.

Abebe Gebeyehu et.al (2018) The purpose of this research is to see whether Typha latifolia can be successfully grown in a hydroponic bioreactor to treat brewery effluent. At a hydraulic retention period of 5 days and a mean hydraulic loading rate of 0.023 m3 m2 d 1, triplicate hydroponic bioreactor treatment units were planned, built, and operated. T. latifolia was gathered from the area around the location to provide fresh material. Utilizing APHA-recommended techniques, we studied the parameters of the wastewater, the plant development, and the accumulation of nutrients during the experiment, and we calculated the difference between the inlet and outlet values to determine the effectiveness of the nutrient removal. The results demonstrated that T. latifolia had a strong phytoremedial ability to remove nutrients and thrived in hydroponics despite changes in wastewater loads. Total Kjeldahl Nitrogen had a removal efficiency of between 54% and 80%, NH4+-N had a removal efficiency of between 42% and 65%, NO3-N had a removal efficiency of between 47% and 58%, and PO4 3+-P had a removal efficiency of between 51% and 70%. When compared to the control, the system enhanced removal by as much as 29% and generated biomass at a rate of 0.61 to 0.86 kg DW m 2. Up to 21.17 g N kg 1 DW and 2.87 g P kg 1 DW were saved. We conclude that hydroponics technique using T. latifolia has potential use for treatment of brewery wastewater and comparable agro-industrial wastewaters as a result of the large nutrients reduction realized and the creation of biomass. In light of this, it may be a viable environmentally friendly choice for treating wastewater and reducing water pollution. There is room for development in the integration of biomass treatment and production.

POTENTIAL OF HYDROPONICS IN INDIA

The miraculous potential of growing in water rather than soil is the first thing that comes to mind when contemplating hydroponics. Hydroponics is so promising that even NASA has been trying it out in orbit. It requires simply that you provide the root zone with oxygen, water, and nutrients.

This cutting-edge innovation is gaining traction in the Indian market, and with good reason. It finds much of its success in the startup industry and metropolitan areas. To explain, consider the following:

It's the ultimate antidote to pollution and infertility since it doesn't need soil.

Humidity, light, temperature, ventilation, etc. may all be adjusted to your liking.

This method of water management permits recirculation and eliminates wasteful run-off.

It helps you keep tabs on plant nutrition and provide them with what they need.

It's a great solution for places with little space and can be used everywhere.

To your knowledge, what follows is the finest part? If you grow your plants in an environment where you have complete control over the lighting, temperature, humidity, and fertilizer levels, you'll see increased productivity. Hydroponics, it would seem, is the way to meet the world's ever-increasing need.

HYDROPONICS MAXIMIZES USE OF RESOURCES FOR EFFICIENT AGRICULTURE

Hydroponics is a modern technique for growing plants, often agricultural products, without the need of soil. Hydroponically produced plants achieve greater height and greater health than their soil-grown counterparts.

Despite the fact that hydroponic farming's popularity is growing, the initial investment required to start up a farm is far more than that of conventional farming, particularly in countries like India. You'll need access to a building or something similar so you can control the climate and nurture your plants, as well as trays and tubes made of food-safe plastic. In most cases, the price of such facilities is more than Rs. 50,000 per 1,000 square feet. The installation of a state-of-the-art plumbing system and automation features (such as sensors, controllers, water pumps, lights, etc.) does not come cheap. Costs for things like consultants, water purification, and the creation of synthetic plant nutrients like nitrogen, potassium, calcium nitrate, phosphorus, and other micronutrients like manganese, zinc, etc., are also necessary.

The agricultural community as a whole is ill-informed about the problems and solutions presented by modern technology. The expertise required is high enough level that it allows for minute adjustments to the environment's temperature and humidity. Crop failures due to improper temperature maintenance are costly. Most farmers don't even know what hydroponics are, much alone how to use them. When we consider that the startup sector of young urban Indians is where this technology is growing, the problem becomes all the clearer.

HYDROPONICS IS THE NEW BUSINESS MODEL

You wouldn't believe the amount of new ventures and micro, small, and medium enterprises (MSMEs) that have developed hydroponics-focused business models as a result of the possibilities presented by this method.

A man named Ramveer Singh from Bareilly, who has a passion for agriculture, has converted his three-story house into a massive hydroponic arrangement.

"Right now, the farm occupies 750 square meters, and it's home to more than 10,000 plants. Hydroponics is how I cultivate all of my harvestable crops each season. PVC pipes and gravity assist move the water through the system. In this setup, he explains, "about 16 nutrients are introduced in the flowing water to the plants.

In addition, his company, Vimpa Pvt Ltd, provides training services, and he has been working on hydroponic systems for other individuals. He makes between 70 and 80 thousand rupees a year from this venture.

It's a common misconception that this method can only be used by farmers.

BEST INDIAN VEGETABLES TO GROW HYDROPONICALLY

Planning on putting up a balcony garden to grow your own produce? Having a supply of homegrown vegetables to use in cooking or sell to a nearby restaurant seems like a dream come true. Hydroponics is an ideal method for doing so since it eliminates the need for messy soil.

You can hydroponically cultivate these Indian vegetables.

a) Spinach

Can you explain why winter is the time of year when I make so many dishes using spinach? Because it's a cool-weather crop, it thrives in conditions of lower temperatures and less light. One of the most productive hydroponic crops is spinach, which may be harvested for a full three months!

b) Ginger

Ginger, in contrast to spinach, thrives in hot, humid climates. As an added bonus, hydroponics, a kind of enclosed farming, works quite well in this environment. Do you hope to produce hydroponically for profit? Then maybe ginger is the crop for you, and there is no shortage of resources to assist you learn about it.

c) Tomato

Although tomatoes are classified as fruits by certain authorities, they are used as vegetables and used as a flavour in many Indian dishes as well as the foundation for many different kinds of curry. Light and a drip hydroponic system will allow you to harvest at any time of year. Tomatoes have a lot going for them, which is why they are so often cultivated in hydroponic systems!

d) Basil

Throughout India, basil is cultivated as more than simply a common herb. It's also great for hydroponic cultivation, yielding a weekly harvest. It also doesn't need a lot of your time or physical resources. Prolific development may be attained with only a drip hydroponic system and 9-11 hours of daylight.

e) Cucumber

Cucumbers are a staple crop for large-scale hydroponic farms. When grown in a drip hydroponic system, it has a little impact on the environment and produces abundant harvests quickly. However, in order to maximize crop yield, you must expose the plant to intense heat and light!

f) Beans

India is home to several bean species, including those of the yardlong, French, lima, and other types. They produce a lot of food without requiring much care. Within a week of planting, you should observe the first signs of germination. After 6-8 weeks in filtered sunshine, you may start harvesting. Furthermore, harvesting might continue for another three to four months!

g) Radish

Aside from their use in salads, radishes may also be baked into bread. Because of its low maintenance requirements, it is a popular among hydroponic gardeners. The seedlings will emerge in about a week, and the plants will do best in dim conditions and chilly temperatures. Hydroponic deep-water cultivation accelerates their growth.

h) Kale

Indians who are concerned about their health often recommend kale to others because of its nutritional value. This makes it a fantastic plant for commercial cultivation, and even amateur hydroponic growers may achieve astonishing yields. In a water culture setup, all you need to do to see it flourish is offer cold temps!

i) Capsicum

Capsicum is loved by everybody since it may enhance the flavor of any food. There will undoubtedly be a significant market for it if it is hydroponically grown commercially. For this, you'll need a warm environment, plenty of sunshine, and a drip hydroponic system. The daytime temperature has to be lower than the nighttime one.

j) Peppermint

In the past, mint has shown to flourish both in soil and in hydroponics. Growing this fragrant, beneficial plant in hydroponics is perfect since its roots spread quickly. Full sunshine is required, and you should see seedlings in around 16 days. Harvests may be expected every 3 weeks or so from quickly expanding mint plants.

k) Okra

Hydroponic farming is effective with a variety of plants, including okra, also called lady's finger in India. There are also lovely flowers there. During a warm season or when kept in a warm environment, it thrives. When the weather is warmer, okra thrives. After 50-65 days after sowing, it's ready to harvest pods. Pod production lasts for around 6 weeks.

l) Bitter Gourd

Bitter gourd is a spreading vine that is used as a multipurpose crop and is often served as a starter for Indian dinners. Your hydroponic setup should be suitable for growing this kind of plant. When growing bitter gourd, the ideal hydroponic methods are deep water culture and the nutrient film technique. After 12-16 weeks after planting, the green bitter gourds are ready to be picked.

m) Cabbage

Hydroponic cabbage cultivation is simple. It will flourish in any environment with enough light. Raft beds on the water are more efficient than tote systems for growing cabbage, resulting in greater harvests. The cabbage plant grows well in the outdoors and can withstand temperature dips. During the warm and humid months, they thrive best in the shade**.**

CONCLUSION

Finally, the generation of dangerous pests and weeds is drastically reduced with hydroponic farming. This means reduced need for chemical weed, bug, and pest control measures. In no way will the environment be harmed. This technology revolution is on the fringes, but there is a lot of study being done on it right now. The PH and nutrient levels must be checked in every hydroponics system, thus familiarity with these concepts is essential. Focusing on such a system, whether in cities or villages, under government oversight, may boost food output for any country. With careful use, this method can bring about sustainability on its own. As traditional soil-based farming becomes more challenging, the hydroponics business is predicted to expand rapidly in the next years. Eventually, soil-less culture will replace traditional agriculture in a country like India, where urban expansion is surpassing all predictions, increasing both the amount and quality of output and guaranteeing the country's long-term food security.

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