TO STUDY "THE CONCEPT OF VERTICAL FARMING IN INDIA"

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INTRODUCTION

"We live vertically so why can't we farm vertically"

Vertical farming is the practice of growing produced in vertical stacked layers. The practice can use soil, hydrophonic or aeroponic growing methods. Vertical farm attempt to produce food in challenging environment, like where arable land is rare or unavailable. The method helps mountainside towns, dessert and cities grow different types of fruits and vegetables by using skyscraper like designs and precision agriculture methods. Most vertical farms use enclosed structures similar to greenhouse that stcak vertically, either directly above each other or staggered for better natural light exposure. If saving space is utmost importance, hydroponic methods as a growing medium as a soil allow for reduce weight and lower water up by to 70%. The use of aeroponics further reduces weight and water requirements. Most vertical farms are either hydroponic or aeoponic and do not have run off, which would make the potted plants heavier. Vertical farming typically uses the mix of natural lights and artificial lights. Artificial lights are often LED based and may be driven by a renewable power source such as solar power or wind turbines. Supporters of vertical farming praise the impact it can have now and in the future to increase food security and have a positive impact on human health. It could decreed forestation and pollution, and help urban areas be self-sufficient. Critics of vertical farming claim the most designs don't efficient deliver the necessary artificial light to keep the design green many vertical farms have hefty electrical bills to produce yields. Furthermore, is disputed as critics argue that the problem is not a lack of farmable land but inefficient usage. Due to limited access of land for farming, tasks so as to pave the way for adding to food needs. Many aspects press on food industry as processing such as : growth of population and its growing needs accordingly, reduction of natural sources due to growing cities, earth erosion, different forms of contamination, advent of biofuels, restrictions imposed on food production techniques affected by customers and rules providers which requires better quality, less use of chemicals and many useful environmental attempts from" farm to fork"

Aim: To study about the concept of vertical farming in India.

Objectives:

1. To study about the purpose of vertical farming in India.
2. To study about the growth and development of vertical Farming in India.
3. To learn the advantages and dis-advantages of vertical Farming.

Limitations:

The study is limited to Indian vertical farming practices only due to time and money constraints.

REVIEW OF LITERATURE

Purpose of vertical farming in India

Their goal is to create a hydroponics model cultivating farm fresh unaffected by weather or soil /conditions. They will be grown in a protected, green house environment. Only a expert gardener knows how difficult it can be grow plants and how much extra care it takes with special attention to soil, fertilizer and light. One can't get the process right and expect good yields without getting his/her hands dirty. But to make their work a lot easy and convenient, many startups in India are working on hydroponics farming. Hydroponics or growinral nutrient solutions in water solvent. Additionally, this indoor farming technique induces plant growth, making the process 50% faster than growth in soil and the method is cost affective. Mineral nutrient solutions are used to feed plants in water. g plants in water or sand, rather than soil, is done using mine

World scenario of vertical farming.

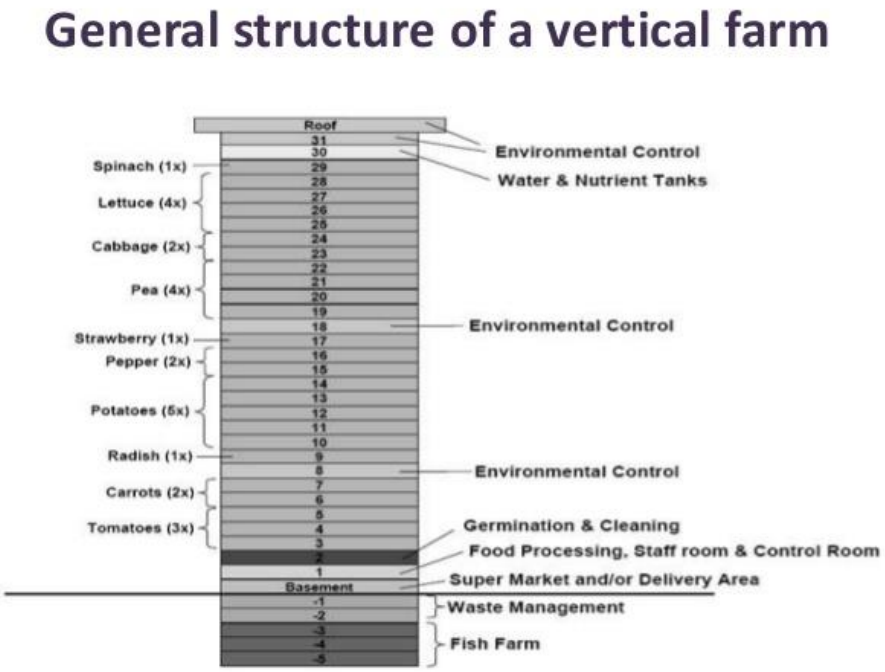
In 2013 the association for vertical farming was founded in Munich, Germany. As of 2014, vertical fresh farm was operating inn buffalo, New York, specializing in salad greens, herbs and sprouts. In march the world's then largest vertical farm opened in Scranton, Pennsylvania, built by green spirit farms. Old, abandoned urban factories make for nice vertical farms. But they might be best suited for environments like the United Arab Emirates, where arable land is limited but sunshine, which can be used for clean energy, is nearly limitless.

Position of vertical farming in India

Vertical farming is limited in India at present to high value crops only. Cultivation under polyhouse and net house is done mostly in case of export oriented flowers and some vegetables. Vertical farming is also in vogue for production of disease free nursery in case of banana, sugarcane, citrus fruits and many flowring plants. Most common and successful vertical farming ex; mushroom cultivation. Temperature and humidity controlled condition are economically possible to be created at limited space. The scope of vertical farming is how ever increasing fast in India. The scheme has been reflected as one of the high priority area. Good technical and financial support is now available for establishing vertical farming units and protective agriculture.

General structure of vertical farming

The vertical farms differ from one city to another. More general tips on this structure as well as more design and concepts of vertical farming are explain in the following structure.



Lighting

Lighting is a key issue in VF. To manage the production line, whether the vertical farm is planned to be totally using artificial light or both artificial and natural light should be taken into account. The same issues need to be considered in designing the facility . There are two options available: LED (light emitting diode) or HPS (high-pressure sodium). The range of light intensity needed for enhancing the growth of vegetation is contingent on the setting and time, product, heat and CO2 content of the air around plants. Considering all these, the normal range of light intensity utilized is 50-200 mol/m2/s or about 4100-16400lx including high-pressure sodium lamps. The light required in closed space for vegetation growth is about 18 hours a day. In order to maximize how much light enters (and at the same time minimize how much light needed to be produced), they use light shelves. Every window has got the tallest height up to 3.5 meters which are actually the height of each floor.

Natural Lighting

The design of the building is such that absorbs as much light as possible. Especially the roof can be designed so as to get the highest amount of energy from the sun in all seasons in places where the weather is moderate. Other parts of the building can receive sunlight too which is a viable option. In standardized one-floor greenhouses, the main source of energy for lighting is the sun. In a vertical farm, any decrease in the density of stacking inside the building is accompanied by an increase in building cubature. Although natural daylight is the main source of energy received from the outside, there needs to be daylight concentration, direction and distribution strategies conceived so as to use sunlight effectively throughout seasons. The idea of the vertical farm can be applied to many different places and types of weather with divergent amounts of light. Since this concept is quite flexible, it usually leads to modular construction plans and uses diverse ideas in architecture. It also takes advantage of multiple façade modules that integrate ideas that guide lighting. Clearly, sticking solar panels on top of each other has not been suggested by anyone before. Similarly, layers of plants cannot be stacked on top of each other if there is not a reasonable replacement for the light required.

Solar Cell

All operations within the system need to be highly efficient especially the photosynthesis of plants. In order to use the energy of the sun maximally in vertical farms, non-PAR waves (Photosynthetically active radiation) should be filtered since they are not absorbed by chlorophyll. These waves need to be filtered by selected solar cells and need to be used for producing photovoltaic energy. Recently different semi-transparent cells are made. But fewer attempts have been made to make such cells particularly transparent for photosynthetically active wavelengths. The employing red/purple colors with the highest degree of absorption (535 nm) as the basis of desensitized solar cells can be a useful way to produce selected solar cells. Since in VF the area of the vegetation growth is multiplied by the number of stories, PAR, as obtained from natural sources, is not adequate. In order to cut down on the need for supplemental artificial light, solar energy needs to be gathered by a system of mirrors from the buildings around the city. This would help to raise the outcome of selective photovoltaic generators and also promote PAR in a vertical farm. What was gained from the energy model showed that sufficient energy was obtainable from certain aspects of the site in order to satisfy the needs for energy (light and water both) within one month? The results show that adequate amounts of energy can be gained from solar panels inserted on roofs or the façade of the building where they can absorb sunlight and there are pumping facilities too. The third dimension needed lighting and was quite practical. The eventual three dimensions led to the lack of energy that is there was a need for more panels that the building to hold.

LED

As mentioned previously, besides natural light, there is a need for artificial lighting too and one such source can be LEDs (Light Emitting Diodes). LEDs that have a longer life and lowering price are decent choices. There are many alternatives that can help to provide for night interruption (NI) or Day Extension (DE) but LEDs are increasingly used as a source of light for plants. Among their advantages are a long life, efficiency in energy, the capability of targeting particular light wavelengths to better manage the photoperiod. This can be realized by using LED lamps that consist of several dimmable diodes which have a divergent color spectrum. This type of lamp may be programmed so as to produce a light fit to the requirements of plants. LED technology helps to save energy by adjusting the strength of light as well as its spectrum via a method devised in Chalmers University . Another advantage of LEDs is that they regulate the proportion of red color (R) and far-red

(FR) to get the best answers from plants. If this proportion is low, the stem elongation is also increased. This is a shade avoidance technique in which plants are shaded by those surrounding them. The optimal mixture of R/FR as well as red/blue is under investigation right now. But, there is a need for further research about awide range of ornamental plants. As an instance, just red light is used for lettuce. There was a poor correspondence between high-pressure sodium lamps and the spectrum used by plants during photosynthesis. Not much of the red and blue light plants need is received. But, they receive a lot of infrared light that is detrimental to some products, and also the yellow light that cannot be used very much. Such organizations as NASA in a controlled environment for agriculture space investigated LEDs and found them as the best lamps requiring red and blue to make a good environment for plants to grow. Red light is required for photosynthesis while the blue is for creating an optimal environment for plant morphogenesis. This is all to enable food production in closed contexts. Red and blue are the best colors for LEDs.

Control Environment System

HVAC Sub-system

Temperature, air conditioning, and ventilation system are allimportant in designing of VF. The following privileges of HVAC (Heating, ventilation and air conditioning) system make it suitable for VF: indoor quality of air, saving energy, consistency of moisture and heat in vertical farms provided by the shades of plants. The building which uses the least energy possible is highly efficient in saving energy.cooling of the building which depends on the geographical coordinates of the vertical farm. Using regenerative energy needs to be supported by sensible and sufficient distribution and transfer systems. The following are suggested to be within this procedure: use of geothermal equipment, heat pumps, and solar energy plants for heating or cooling along with the opportunity of using ground water or surface water.Water supported systems translocate thermal loads. To realize regenerative energy, earth canals are used along with air collectors to adjust the required healthy quality of the air outside. There is a constant monitoring of the heating conditions of the inner area in individual sections of a vertical farm.

Smart Devices

As a totally automated operation, VF makes a great use of sensors and actuators (known as smart equipment) that also interact with other systems with no human interference. In order to realize VF as a technology, there needs to be a comprehensive calculating system which is constantly aware of the environment and helps to generate proper information and services. There is a database which covers every information about the crops and the probable diseases. Even in conditions where the crops grow inside buildings, there is a need for outdoor weather when the ventilation system. Information about the weather is gained from weather forecast in real time and based on this information appropriate decisions can be made. Information about the context is required to make the right decisions about selecting the controller.

Water required

70% of the existing fresh water would go for modern farming. Much of this loss in because of the artificial watering of farms also most of the irrigation water gets loss due to evaporation. The evaporation is natural procedure but their exist a bigger problem which is the water that goes out of the farm as run off which is useless for drinking. When farms are transfers to indoors, less water is lost due to the above mention reason that can be use in plant growth instead. The amount of water needed for hydroponic agriculture was estimated to the one litre for each sq.ft a day. There are number of techniques used in vertical farming to resist the lack of water.

Renewable energy in vertical farming

The current energy need to be quantified is to specify the amount of energy required to empower a target building and also whether reusable energy could be satisfy the target demand of the building or not. The vertical farm need the following; lighting and temperature for plant to grow, and ventilators, heat pump use to manipulate the climate, pumps use for diluting nutrients, agitators use to control plants. Vertical farming was presided by renewable technologies which emerged long ago as highly transforming. There are many types of socio or economic organizations that follow these technologies.

Advantages of vertical farming

Vertical farming has many advantages such as that it allows maximum crop yield. Vertical farming can allow crops to be grown at all times throughout the year, as it is not weather depended. It can also be grown throughout the entire day and night as it uses LED lights since photosynthesis can occur at all times. It reduce the transportation as it will be cheaper for transportation since you can built vertical farms in cities. It is eco-friendly as decreased need for transportation means pollution. Since the water is used in control manner, water

looses are very minimum. Vertical farming only use 10% of the water that traditional method is used. Currently 70% of the accessible potable water is used for agriculture this can be decrease using vertical farming. So it is healthier, safer and more eco-friendly.

Data collection

Primary data: The primary data was collected from different pod of the agents of India.

Secondary data: Secondary data was collected by different websites.

Data analysis

The researcher took the primary data after looking about the presentations of different environmental agents. It was found that all the agents and operator found the potential in vertical farming and would like to suggest the development and concept of vertical farming in other cities of India. The research operates same responses from all the presentations and operators; hence the data was not tabulated.

Conclusion

Agriculture is one of the activities that play the main role in supporting a human in the world. However, drinking water is already in shortage stage, but, most of the available freshwater, is already using for agriculture. More than 20 percent of the fossil fuels annually is using for agriculture in industrialized countries. Farming has become more fund centralized during the last years. Developing the high-tech farming systems are the results of the energy sources and new methods of farming. Moreover, overpopulation of cities needs new agricultural methods so as to bring conventional farming inside cities. A single technological strategy cannot be a panacea to the ever-growing food production system. Instead, there is a need for a mixture of multiple techniques to guide us towards the 21-century green revolution. Vertical farming is one of the greatest interesting examples of somewhat new that may contribute to these answers. Others have mentioned to this occurrence as controlled environment agriculture or agriculture integrated building also have basically involved it as technical elements within the superior phenomenon of urban or local agriculture with different food production. Vertical Farming has the potential way for sustainable progress to produce food or related services in urban areas. The goals and future vision have been planned with the purpose of generating sustainable cities around the world. To sum it up, to create a city context where most of human food needs are met by self production and recycling and reusing drinkable water would not be far-fetched since the required technologies are already availed. Where there is strong enough motivation and adequate social pressure, prospective eco-city can be actualized soon enough.

The recent traditional farming approaches due to a great imbalance in the environment. In the other hand, the recent environmental approach caused by concentrated traditional farming approaches that contribute to the ecological problem has been overviewed. Agriculture it still plays a very significant role in many cities. It causes thousands of acres of forest land to be plowed up sacrificing thousands of acres of land. Endmost, it appears that the concept of the vertical farm in the city center of urban areas could solve a lot of real issues related to food production and environmental degradation. Then no harvests would fail by severe weather phenomenon like droughts, floods, and hurricanes, etc. Hence, the vertical farming making of a sustainable city environment that encourages the people to live there for the safe and healthy environment, cleaner air, safe drinking water, safe usage of public liquid waste, new employment chances, and less abandoned lots and constructions. Vertical farming has the benefit of a seasonally wet and warm weather. They can easily minimize cooling and heating water, use of indoor temperature and artificial light and also. Sustainability of city Building Integrated Agriculture have a plentiful amount of natural resources such as long hours of sunlight and enough water from daily rain to cultivate. As a conclusion, the number of technologies provided for decreasing the agricultural effect on the earth as well as oceans is restricted although it helps to sustain the increasing human population. From our perspective, VF is among the few novel paths to fully delve into the following 10 to 20 years particularly if we really aim to live in a balance with other living organisms and not to threaten their life nor ours. Optimally, VF is required to be: a. cheap and affordable b. resistant and securely operable c. not requiring financial subsidies or external support. In case these conditions are met in a dynamic, all-inclusive research programs, farming in cities can supply many foods for 60% of the population who reside in cities up until 2030. VF has the potential for success in proper conditions. It simultaneously helps to reduce poverty, adds to food safety, and increases contextual sustainability and human well-being.

Suggestions and recommendations.

- Vertical farms are very powerful concept in part because they do not requires soil to yield crops.
- Research has showed it is possible to produced experimental plants under 100% LEDs with no negative outcomes on plants.
- Vertical farming can allow crops to be grown at all times throughout the year, as it is not weather dependent.
- Vertical farming can reduce transportation cost as it will be cheaper for transportation since you can build vertical farm in cities, so you don't need to import the crops from other region.
- The basic advantages of vertical farming is that it uses very minimal water. Since the water is used in a controlled manner, water losses is very minimal.

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