Review Article

REVIEW ON VERTICAL FARMING IN AGRICULTURAL AREA

Abstract:-

Vertical farming has the capability to produce the food or any other services in urban areas which are related to it. The goals and vision of vertical farming is planned with the aim of generating sustainable cities around the world.The recent traditional farming approaches due to an imbalance in the environment. At the end it appears that the concept of the vertical farm in the city centre of urban area could solve various issues that is related to food production and environmental degradation. No crop harvests would fail by severe weather like droughts, floods and hurricanes etc. Hence the vertical farming aims at the making of the sustainable city environment that inspires the people to live there for the safe and the healthy 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, 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 have a plentiful amount of natural resources such as long hours of sunlight and enough water from daily rain to cultivate.

Keywords: artificial light, controlled environment, indoor farming.

Introduction-

In recent time due to increase in populationit became hard to fulfil the food requirement of growing world population, to solve such a problem vertical farming came as solution where land is no longer a limiting factor for growing plants and made it possible to grow much larger amount of agriculture produce in a very small area.

Increased urbanization, climate change, adverse environmental situation and usage of chemicals in agriculture like insecticide and pesticides all have affected the soil fertility and productivity and land area for agriculture for individual person has also decreased **(Lambin, 2012; Lal, 2015 and Lehman et al., 2015).**

Traditional methods of soil based farming is facing problems in fulfilling the food security of world population along environmental friendly agricultural practices which generate the need to switch from traditional methods to modern technology in agricultural production (**Lambin and Meyfroidt, 2011).**

"Now food security has become a major worry. There is shortage of land, according to the experts in the field of land use (such as agronomists, ecologists, and geologists)". (**Corvalan et al 2005 and Thomaier et al 2015)**. "There is a need of the solutions to this problem (Muller et al 2017). In vertical farming we can produce food on a smaller area". (**Touliatos et al 2016)**"On the other hand, indoor farming is providing better conditions for growing food"**(Mukherji and Morales 2010).**"In Indoor farming we can grow crops throughout the year and is also weather independent and it also has the capability to produce higher yields and can give us year round income". **(katz and Bradley 2013).**"It is also possible that we can successfully reduce the cost of travel and discharge of GHG by decreasing travel distances between remote farms and local markets via indoor farming"**(Astee and kishnani 2010).**

With problems like climate change, adverse environmental situations, insect pest infestation, etc. Vertical farming is a safer option as we grow plants in controlled environmental condition which can be altered in order to gain highest yield. Recent situation like covid outbreak has also made us realised the how easily our food security can come to risk, with the help of vertical farming we can provide fresh food in urban area by growing it in a small closed area. Beside agriculture vertical farming also has a good scope in landscape designing and beautification with green walls and vertical gardening.

Concept of vertical farm:

Vertical farming involves growing of crops in vertically staked layers. It often incorporates controlled environment agriculture, which aims to optimize plant growth and soilless farming techniques.

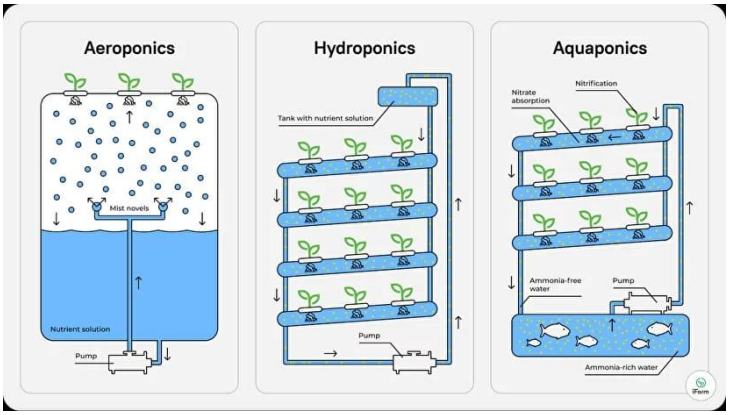

Figure 1 Different methods of vertical farming.

The vertical farming is feeding the world in 21st century. The plan of vertical farming focuses to uplift the rate of efficiency (**Benke et al 2017).** Closed growing systems does not prefer the chemicals so these are kept outside the environment **(Van OS, EA 1999).** Soilless agriculture like hydroponics, aeroponics etc can be started successfully without any risk and is also considered as another possible way for cultivating healthy food plants, crops, or vegetables in this current era (**Despommier, 2013**). "As urban population is growing rapidly ,food security is also growing rapidly. This is where vertical farming comes into existence" (Corvalan et al 2005; Healy and Rosenberg ,2013; Thomaier et al, 2015 and Despommier ,2010).

Grow your food by your way than becoming dependent on imports **(Touliatos et al 2016).**

"The various types of vertical farming have been determined on the subject" (**Muller et al 2017)**. "Vertical farming term was first used by Gilbert Ellis Bailey in his book "vertical farming" published in 1915. Hydroponics was introduced by William Frederick Gericke at the University of California, Berkley in early 1930s. In addition to traditional farming, which is a large scale agriculture system includes massive irrigation, intensive tillage, as well as the use of fertilizers, pesticides, and herbicides the vertical farming inspires towards sustainable farming"**(Healy and Rosenberg, 2013)**

Constraints of vertical farming

Despommier mentioned a lot of important points regarding this topic in his book named "The Vertical Farm: Feeding the world*in the 21st century" and they are as follows :-

(1) with the help of vertical farming we can get nutrient enriched fruits and vegetables throughout the year.

(2) There's no effect of seasonality in case of vertical farming as compared to traditional farming.

(3) In case of vertical farming there's no use of chemical fertilizers and pesticides as these vegetables/fruits are grown in a very controlled manner which ensures a very healthy produce/output as compared to traditional farming.

(4) The plant efficiency is higher and the growing cycle of the plants is also very shorter in comparison to the plants grown by the traditional farming.

(5) The harvest/output which comes from the vertical farming also doesn't require a large amount of transportation which means it can be easily distributed among the urban population which will also lead to a decrease in the usage of non-renewable resources such as petrol, diesel etc.

(6) Through vertical farming we can also decrease the amount of water usage as compared to traditional farming which will also ensure the availability of the water for other important work.

"As a result of traditional farming practices both natural and human environments are frequently harmed because these are not given proper attention" (Despommier 2010, Touliatos et al 2016).

Plants grown in Vertical Farming

Well in case of vertical farming the amount of different types of crops grown is very limited because of many reasons and it case of VF, leafy vegetables are mostly preferred because they are very small in size which means they will take a very less amount of space which will be very beneficial to those people who are practicing this in their homes. Secondly as they grow in a very large number it leads to a better yield and better income per unit area. Most importantly as these crops grow within a very short span of time so there's a high chance that they can be grown by the growers multiple times in a year.Some examples of fruits and vegetables grown in vertical farming are : leafy greens (e.g. lettuce, kale, spinach), herbs (e.g. basil, mint, parsley), microgreens, strawberries, and even some root vegetables (e.g. radishes, turnips).

Management of vertical farming

Growing medium

The type of growing media provides the nutrition to relatively shallow depth or limited volume in containers, is the most important component in vertical farming. Field soils are generally not used for the production of plants in containers. Mixing of cocopeat, vermiculite and perlite in the ratio of 3:1:1 on volume basis was observed to be one of the best growing media.However to bring down the cost locally available inert media needs to be standard.

Water and Nutrient management efficiency in vertical farming

In vertical farming the elevation difference between the first row (bottom one) and top row (upper one) is considerable and the water emission rate from dripper gets affected by the difference. Since success depends on the relation between head and discharge the network of pipes and dripper discharge need to be such that all plants get same amount of water irrespective of their location. For the quality of production, irrigation water needs to be free from undesirable chemicals and pathogens. With the help of fertigation as much as 60% fertilizers are saved. Appropriateand accurate design of irrigation and fertigation is needed so that the pressure and discharge requirements are maintained. Essentially the drainage and recirculation of water nutrients solution needs to be monitored for its electrical conductivity and ph.

Conclusions:-

Vertical farming is rapidly becoming more appealing to the world due to its ability to deliver r eliable and sustainable food. It can reduce water consumption and land degradation, lower pe sticide/fertiliser use, and shorten the food supply chain. Therefore, we suggest that more resea rch and collaboration are important to bring together the current technological practices to inc rease sustainability. Furthermore, it is expected to optimise product quality in vertical farming and urban agriculture for new capabilities in the agricultural and horticultural industries.

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