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Vertical Agriculture-A Forward Food Production System

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Introduction:

Land is the Primary input for agriculture. Keeping other things constant one can't raise crop without land in conventional farming. World's population is expected to exceed 90 billion by 2050 with 15% of the world's population living in India. In order to produce sufficient food for the increasing population in the limited available land we need to gear up to develop new technologies that can raise yields by making best use of the limited area along with protecting the environment. To achieve this and to protect the environment some technologies like Perm culture, hydroponics and vertical farming, etc have emerged. Vertical farming is the technique of cultivating crops in vertically stacked layers with or without use of soil under controlled environments following methods like aquaponics, aeroponics and hydroponics, etc.

How it works?

The term Vertical farming was coined by Dickson Despommier, a professor of public health and environmental health at Columbia University in the year 1999. Prime features of vertical farms include controlled temperature and humidity, artificial lighting and controlled use of fertilizers. A range of vertical farming systems operate all over the world such as 1) Despommier skyscrapers (vertically piled shelves where crops are grown under regulated conditions), 2) Mixed use skyscrapers (crops are grown in open sunlight on terraces/open top floors of buildings) and 3) Stackable shipping containers (recycled piled cargo containers which are used to cultivate strawberries, gourmet mushrooms and green leafy vegetables) which operate through processes such as Hydroponics (cultivation in nutrient rich water with the support of gravel & sand instead of soil), Aquaponics (combination of fish culture and hydroponics) and Aeroponics (a NASA initiative which doesn't require liquid/solid medium to grow, instead upright hung plants are misted with nutrient rich solution) to grow crops in

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buildings especially in urban areas under controlled conditions with limited resource utilization and environmental harm.

Benefits:

1. Efficient use of inputs: Compared to conventional farms, vertical farms utilize small area to cultivate number of crops, conserves water as seepage losses are reduced and give higher yields per unit size of the land.
2. Year round income: Different types of vegetables are produced throughout the year in vertical farms under controlled conditions which provide assured income to the farmer.
3. Conserves environment: Operations like plowing, planting, chemical sprays and emissions from fields can be avoided in the vertical agriculture which reduces harm to the environment.


Challenges:

1. Overwhelming initial costs: Vertical farms which were set up in urban areas require high investment and they involve high costs in order to maintain controlled environment throughout the year.
2. Pollution: Co_2 emissions from vertical farms are high which increase the air temperature outside the farm. Some vertical farms release the used water contaminated with plant protection chemicals and chemical fertilizers without purification.

How it is different from urban agriculture?

Urban agriculture refers to cultivation of crops in the areas which are nearer to cities or cultivating crops in leased lands in urban areas whereas vertical farming is the cultivation of crops in buildings or open place under controlled environments.

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- Urban agriculture requires more land compared to vertical farms which can be designed in buildings or rooftops.
- Cultivation in urban farms depends on weather conditions but weather effects are controlled in vertical farms.

How it is profitable in India?

India is hosting 60% of the agriculture dependent population and many more are searching for opportunities in agriculture. In this context in order to ensure food security and provide needful employment to its increasing populations, it needs to utilize the limited land and resources in a best way. Most of the post harvest losses to cultivators occur in storage and transportation of the produce to the cities. In vertical farming one can grow a range of fresh vegetables throughout the year under controlled environment with minimum losses in urban areas or near urban areas in buildings or terraces which makes transportation easy. Organic cultivation is easy in vertical farms as vertical farms overcome the disadvantage of chemical runoff from the other farms. A balanced use of fertilizers and pesticides is possible through these farms. These farms employ educated unemployed youth who can acquire skills, thus providing additional employment. They can reduce the burden of import as some of the temperate crops can be grown in vertical farms under controlled conditions.

Conclusion:

In the light of multiplicating population and slowly creeping food production vertical farming can be a best solution to ensure food security and provide employment to ever growing urban population. Vertical farming facilitates year round cultivation of crops under controlled environments with minor challenges yet appreciable benefits.