Thaxted Astronomical Society

Interesting Features

IF0019

Vertical Farming

https://en.wikipedia.org/wiki/Vertical_farming

What is vertical farming?

Vertical farming is the practice of growing crops in vertically stacked layers.

It often incorporates controlled-environment agriculture, which aims to optimize plant growth, and soilless farming techniques such as hydroponics, aquaponics, and aeroponics.

Some common choices of structures to house vertical farming systems include buildings, shipping containers, tunnels, and abandoned mine shafts.

As of 2020, there is the equivalent of about 30 ha (74 acres) of operational vertical farmland in the world.

The modern concept of vertical farming was proposed in 1999 by Dickson Despommier, professor of Public and Environmental Health at Columbia University.[3] Despommier and his students came up with a design of a skyscraper farm that could feed 50,000 people.

Although the design has not yet been built, it successfully popularized the idea of vertical farming.

Current applications of vertical farmings coupled with other state-of-the-art technologies, such as specialized LED lights, have resulted in over 10 times the crop yield than would receive through traditional farming methods

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What is vertical farming?

The main advantage of utilizing vertical farming technologies is the increased crop yield that comes with a smaller unit area of land requirement

The increased ability to cultivate a larger variety of crops at once because crops do not share the same plots of land while growing is another sought-after advantage

Additionally, crops are resistant to weather disruptions because of their placement indoors, meaning fewer crops are lost to extreme or unexpected weather occurrences.

Because of its limited land usage, vertical farming is less disruptive to the native plants and animals, leading to further conservation of the local flora and fauna

Vertical farming technologies face economic challenges with large start-up costs compared to traditional farms.

In Victoria, Australia, a "hypothetical 10 level vertical farm" would cost over 850 times more per square meter of arable land than a traditional farm in rural Victoria.

Vertical farms also face large energy demands due to the use of supplementary light like LEDs. Moreover, if non-renewable energy is used to meet these energy demands, vertical farms could produce more pollution than traditional farms or greenhouses.

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What is vertical farming?

Hydroponics

Hydroponics refers to the technique of growing plants without soil.

In hydroponic systems, the roots of plants are submerged in liquid solutions containing macronutrients, such as nitrogen, phosphorus, sulphur, potassium, calcium, and magnesium, as well as trace elements, including iron, chlorine, manganese, boron, zinc, copper, and molybdenum.

Additionally, inert (chemically inactive) mediums such as gravel, sand, and sawdust are used as soil substitutes to provide support for the roots.

The advantages of hydroponics include the ability to increase yield per area and reduce water usage.

A study has shown that, compared to conventional farming, hydroponic farming could increase the yield per area of lettuce by around 11 times while requiring 13 times less water.

Due to these advantages, hydroponics is the predominant growing system used in vertical farming

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Aquaponics

The term aquaponics is coined by combining two words: aquaculture, which refers to fish farming, and hydroponics—the technique of growing plants without soil.

Aquaponics takes hydroponics one step further by integrating the production of terrestrial plants with the production of aquatic organisms in a closed-loop system that mimics nature itself.

Nutrient-rich wastewater from the fish tanks is filtered by a solid removal unit and then led to a bio-filter, where toxic ammonia is converted to nutritious nitrate.

While absorbing nutrients, the plants then purify the wastewater, which is recycled back to the fish tanks.

Moreover, the plants consume carbon dioxide produced by the fish, and water in the fish tanks obtains heat and helps the greenhouse maintain temperature at night to save energy.

As most commercial vertical farming systems focus on producing a few fast-growing vegetable crops, aquaponics, which also includes an aquacultural component, is currently not as widely used as conventional hydroponics

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Aeroponics

The invention of aeroponics was motivated by the initiative of NASA (the National Aeronautical and Space Administration) to find an efficient way to grow plants in space in the 1990s

Unlike conventional hydroponics and aquaponics, aeroponics does not require any liquid or solid medium to grow plants

Instead, a liquid solution with nutrients is misted in air chambers where the plants are suspended

By far, aeroponics is the most sustainable soil-less growing technique as it uses up to 90% less water than the most efficient conventional hydroponic systems and requires no replacement of growing medium

Moreover, the absence of growing medium allows aeroponic systems to adopt a vertical design, which further saves energy as gravity automatically drains away excess liquid, whereas conventional horizontal hydroponic systems often require water pumps for controlling excess solution

Currently, aeroponic systems have not been widely applied to vertical farming, but are starting to attract significant attention.

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https://envirotecmagazine.com/2021/11/08/what-is-vertical-farming-why-is-it-growing-in-the-uk/#:~:text=Vertical%20farming%20is%20where%20crops,attractive%20proposition%20in%20the%20UK.

What is vertical farming? Why is it growing in the UK?

Vertical farming is where crops are grown, usually indoors, in stacked layers. The farmer can control the environment – lighting, temperature and water provision – without having to suffer the vagaries of the weather. For reasons that should be obvious, it is an attractive proposition in the UK.

And it is growing globally. in 2018, it was worth £1.72 billion and set to rise to £9.84 billion by 2026. Food cultivated by this kind of indoor farm production includes fruit and vegetables, until recently reliant upon traditional farming methods.

It is seen as a sustainable way to grow healthy food with minimal environmental disturbance. Both water and land use are minimised, and food supplies are not subject to changing weather, which can lead to food scarcity. When the vertical farm is built near the markets, transport costs and carbon footprints are reduced.

It can be carried out in specially designed buildings and in such places as underground tunnels, chipping containers, and even a chiller cabinet.

The special trays are soil-less, and water can be supplied as water to the roots or as a spray mist.

LED lighting can be adjusted to provide wavelengths to suit the crop being grown, and pesticides are not needed. The farmer has full control of the environment.

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What is vertical farming? Why is it growing in the UK?

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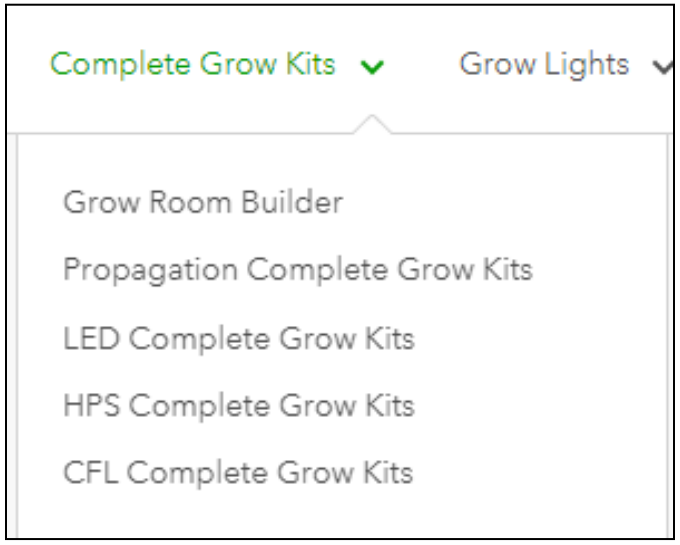
https://www.londongrow.com/pages/commercial-farming-and-vertical-farming-design-services?gclid=Cj0KCQiApL2QBhC8ARIsAGMm-KHJkJldw9Pzb7Eepl-L53N87I_y6Dnkq3tOhSwDV_uNmblul9wtGcYaAsvnEALw_wcB

London Grow >

Commercial Greenhouse and Vertical Farm Design

We believe that hydroponics is the future for the food market. Traditional methods of growing take up larger amounts of space, and generally require more energy and physical maintenance. Hydroponics can increase production speeds, whilst reducing waste making it an ideal way of working towards a greener future.

If you're looking to set up a commercial facility, or streamline an existing project, we can help! Our team of expert consultants can supply, design and plan out your grow space to ensure optimal results by using state of the art technology and expert industry knowledge. At London Grow we want to help you make your vision come to life using the products you have in mind, with our expert guidance.



https://www.theguardian.com/environment/2021/oct/18/its-not-as-carbon-hungry-uks-largest-sunlit-vertical-farm-begins-harvest

Shockingly Fresh's first giant greenhouse>

The largest naturally lit vertical farm in Britain has begun harvesting and the creators plan to build 40 more.

It looks nothing like a traditional farm, with bright white towers of leafy green vegetables stacked as high as the eye can see. But Shockingly Fresh's first giant greenhouse, in Offenham, Worcestershire, is harvesting thousands of bunches of pak choi and lettuce destined for supermarket shelves. The farm is suited to a variety of leafy greens, as well as strawberries and herbs.

The company says their model uses less water and yields many times more plants than field growing.

Nick Green, the development director of Shockingly Fresh, said: "This first farm will grow about 2m heads of leafy greens a year – around four times the yield we would expect on a patch of land this size."

Unlike the majority of vertical farms, which use fully enclosed systems with heating and artificial LED light, Shockingly Fresh uses only natural light.

The dark winter afternoons in Britain mean that, unlike most hydroponic farms, production varies through the year, with fewer crops grown in winter.

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Production isn't completely linear as it would be in a fully-lit vertical farm. But we do match the consumption pattern of people – people don't eat as much lettuce in winter as they do in summer."

Seasonal fruit such as strawberries can still be grown in the colder months, the company says, which could help reduce imports. "It is ultimately better for the environment. I can't say it's carbon-neutral but it isn't as carbon-hungry as an LED vertical farm would be," G
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