

Status of Vertical Farming in North Rhine-Westphalia

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Crops are produced indoors, under artificial light and temperature conditions, in vertical farming. Its goal is to increase productivity in limited areas. It employs soil-free techniques including hydroponics, aquaponics, and aeroponics. Although the number of vertical farms in Germany is currently modest, the industry is quickly growing. Here is overview of the various types of vertical farms present in North Rhine-Westphalia.

I. FRAUNHOFER INSTITUTE FOR MOLECULAR BIOLOGY AND APPLIED ECOLOGY IME

The Fraunhofer Institute is an organization that specializes in the fields of molecular biology, applied ecology and bioresources. Their research is focused in areas like agriculture, chemistry, medicine and others. Their branches are located across four states with their North Rhine-Westphalia branch located in Aachen. The Fraunhofer Institute is developing two vertical farming technologies in Aachen namely OrbiLoop and OrbiPlant.

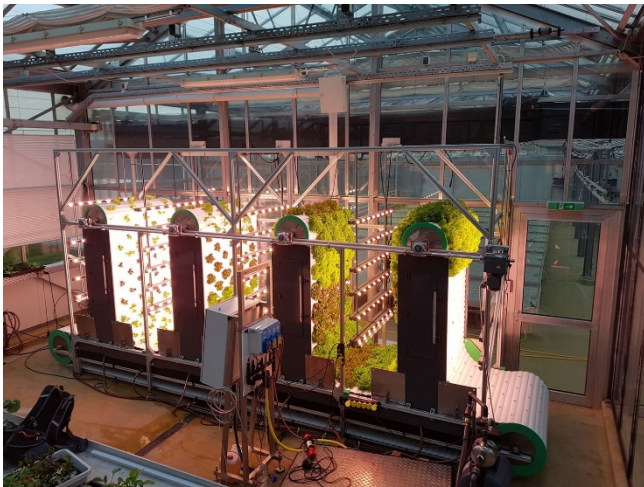


Fig. 1. OrbiPlant system

OrbiPlant is an automated vertical farming technology that provides a 24 m² cultivation area and can be used to grow both edible as well as medicinal plants. The system consists of a conveyor belt that moves in a wave like motion on to which the plants are attached. The roots of the plants protrude out of the inner side of the conveyor belt where they are automatically sprayed with the required nutrients. The conveyor belt also realigns the plants in certain ways that increase the production of certain hormones in the plants which causes quicker leaf growth and higher biomass gain. This way the system combines

two different approaches of aeroponics and orbitropic effect. This system is capable of producing up to 200 lettuce heads and herbs a week.

The other technology being developed by the Fraunhofer Institute is the OrbiLoop which is a smaller version of the OrbiPlant. The conveyor belt in this system, unlike in the OrbiPlant, does not move in a wave like motion but instead it moves in a continuous vertical loop. This system is intended to be used in grocery shops and restaurants to supply the daily requirements for herbs throughout the year.

An upcoming project of the Fraunhofer institute is to set up a vertical farm in Düsseldorf. The project is being carried out by researchers from the organization Fraunhofer UMSICHT. The vertical farm is to be located directly on top of one of Düsseldorf's oldest market squares, Carlsplatz. Researchers from Fraunhofer UMSICHT are currently carrying out a feasibility study for the project to analyze the planned location of the farm and also to define the specific goals of the project. The study will also analyze the acceptance and participation of the Düsseldorf population regarding the vertical farm. This study is set to be completed by December 2021 after which the results will be analyzed, and the development of the farm will accordingly continue.

Furthermore, the Carlsplatz project will draw inspiration from another indoor farm 'ALTMARKTgarten' that is located on the roof of a job center in Oberhausen. The ALTMARKTgarten produces salads, herbs and strawberries across 900 square meters of the job centre's rooftop.

II. STADT GREENS

Düsseldorf is home to the Stadt Greens. Peas, radishes, wheatgrass, sunflower, and broccoli are among the organic microgreens grown in a vertical indoor farm without the use of chemicals or pesticides by the start-up.

The microgreens are provided within 24 hours of ordering, and only within Düsseldorf and its environs, to ensure optimum freshness and fewest transportation routes. The greens' packaging is likewise biodegradable, compostable, and manufactured from renewable resources.

III. BLATTSACHE

Blattsache is also the creator of a vertical indoor farm that is located at the center of Düsseldorf in Flingern.

The vertical hydroponic system of the start-up imitates the natural growth processes through the optimal soil and the ideal light, air, and water supply with exquisite organic seeds from ecological cultivation. Microgreens like sugar peas, radishes,

red clover, baby broccoli, daikon radish, and purple radish are produced.

IV. INFARM

Infarm is a start-up company founded in Berlin in 2013 that has used the concept of vertical farming to establish organically grown herbs and vegetables directly in restaurants or sales outlets and to market and sell them there. Indoor farming startup Infarm raised an additional \$100 million to expand into more foods as the coronavirus pandemic increases interest in growing produce in urban areas.

Infarm, which already grows salad greens and herbs, wants to strengthen its presence in existing markets, hire more people and venture into new crops including mushrooms, tomatoes, and chillis.

V. BLATTGRÜN

Blattgrün is an indoor farm located in Aachen that uses a hydroponic vertical farming system. Their products mainly include microgreens like radishes, sunflowers, peas, mung beans and other vegetables and herbs. They have already started to sell their products in nearby Rewe and Edeka grocery shops as well as local restaurants.

Blattgrün also encourages their customers to start their own indoor farms using another of their products called HydroOne. HydroOne lets customers set up their own miniature hydroponic indoor farms and also comes with powdered nutrients to be supplied to the plants through the water.

VI. STADTFARM

Stadtfarm is a company located in Bad Godesberg in Bonn that also produces microgreens through the use of a hydroponic vertical farming system. Their vertical cultivation techniques include the use of floodable shelves stacked upon each other. This system is also very space efficient as each shelf occupies an area of only 2 m² while providing an area of up to 12 m², when stacked, for growing the plants. The microgreens that they produce include peas, yellow mustard, red radish, garlic chives, mustard cabbage and sunflowers. Their microgreens are produced and harvested on a daily basis after which they are supplied to stores and restaurants in the city.

Stadtfarm also places high importance on sustainability in their farming. They avoid growing their plants on substrates containing coconut or peat as that would support rainforest deforestation and clearing of moorlands. Instead they grow their microgreens on a wood based substrate that has been approved for ecological agriculture.

VII. NEXUS FARMS

Nexus farms has set up their vertical in Wandelwerk which is a former car dealership located in Cologne Ehrenfeld. Their products too are a variety of microgreens including mustard, peas, radish and broccoli. Their products are sold in markets located in Cologne's Südstadt and Schälsick and also through the environment friendly grocery delivery service Himmel &

Ääd. The Wandelwerk is also home to another urban farm, Pilzling, which specializes in growing a variety of mushrooms.

Some downsides of vertical farming are its high energy consumption and limited range of plants that can be grown on them. But with increased research taking place in vertical farming methods, it is likely to become a more sustainable system in the future.

REFERENCES

- Blattgrün*. (n.d.). Retrieved from blattgruen.farm: <https://www.blattgruen.farm/geschichte>
- Blattsache*. (n.d.). Retrieved from Blattsache: <https://www.blattsache.de/>
- Brembach, M. (2021, January 9). *Vertical farming in Düsseldorf*. Retrieved from duesseldorf: <https://www.duesseldorf.de/medienportal/pressediens-t-einzelansicht/pld/vertical-farming-in-duesseldorf.html>
- Farmling by Blattgrün*. (n.d.). Retrieved from blattgruen: <https://www.blattgruen.farm/hydro1>
- Fraunhofer IME develops indoor vertical farming system for plants*. (2020, September 21). Retrieved from Fraunhofer IME: <https://www.ime.fraunhofer.de/en/press/IndoorFarming.html>
- Nexus Farms*. (n.d.). Retrieved from Nexus Farms: <https://nexusfarms.herokuapp.com/>
- OrbiLoop*. (n.d.). Retrieved from OrbiLoop: <https://www.orbiloop.de/en/>
- OrbiLoop®*. (n.d.). Retrieved from Fraunhofer IME: <https://www.ime.fraunhofer.de/de/trendthemen/orbiloop.html>
- OrbiPlant®*. (n.d.). Retrieved from Fraunhofer IME: <https://www.ime.fraunhofer.de/de/trendthemen/orbiplant.html>
- Platzsparend und effizient: Urban Farming*. (n.d.). Retrieved from stadtfarm-bonn: <https://blog.stadtfarm-bonn.de/urban-farming/>
- Sustersic, L. (2021, May 6). *Unkonventionelle Landwirtschaft: Das sind die Start-ups in NRW*. Retrieved from foodhub-nrw: <https://foodhub-nrw.de/news/unkonventionelle-landwirtschaft-das-sind-die-start-ups-in-nrw>
- unsere produkte*. (n.d.). Retrieved from stadtfarm-bonn: <http://stadtfarm-bonn.de/produkte.html>