

# Vertical farming will play a role in future food production, expert says

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Alternative production systems to provide the growing global population with healthy, nutritious and sustainably produced foodstuffs are currently gaining considerable attention. In this interview, Senthold

Asseng, Professor of Digital Agriculture at the Technical University of Munich (TUM), discusses the concept of vertical farming, which will allow agriculture of the future to take place under fully controlled and automated conditions.

**Professor Asseng, vertical farming allows food production to be fully uncoupled from soil and external climate influences. What possibilities and opportunities do you see in such indoor crop growing systems?**

Crops are grown in spaces ranging in size from small boxes that can be placed in homes or offices to industrial production facilities with several thousand square meters of growing area. Vertical farming has the potential to grow up to 100 layers of crops above one another on one hectare of land. This will conserve large areas of agricultural land.

**That sounds revolutionary. What other benefits would this crop production method offer?**

Vertical farming allows multiple harvests of a cropper year and can make a substantial contribution to global food security. If we optimize the [growing conditions](#) for a crop in a closed system, cut off from the outside world, we can reduce water requirements by up to 90 percent and eliminate the need for chemical crop protection.

Yields can be increased by many times through optimal crop care and growth conditions. This includes intensive use of technologies, for example through fully automated management of crops as well as lighting and irrigation systems. This will help to minimize operational expenses.

## **Where do you see the obstacles and challenges?**

Vertical farming has so far proven highly energy-intensive. This has made it unprofitable currently for crops such as grains, although it would be quite conceivable to increase the global mean annual per-hectare wheat yield by a factor of 6000.

I see also a major potential for the production of pharmaceutical and protein crops. Quality, nutrient content and flavors can be precisely controlled in vertical farming. New crop varieties specifically bred for this type of farming offer promising improvements in terms of quality. However, one point must be clear: the production of crops in vertical farms has to be cost-effective.

## **Where do you see the biggest need for research?**

There are still many areas where a lot of research is needed. For example, what factors limit crop growth in vertical farming? Another issue is the conservation and efficient use of energy. If we can answer these questions, we can for example reduce the energy use in such indoor facilities towards making them profitable.

## **So far, vertical farming has been used to grow vegetables. Will this indoor method replace production on conventional crop land one day?**

The success of vertical farming will depend on whether the products can capture a market share. Acceptance on part of consumers will also play an important role. People may take some convincing. That will be possible only through transparency and respect. We also need farmers who are willing to try vertical farming. Farmers have the know-how to grow [crops](#) and have extensive knowledge of cropping systems. We

should therefore involve them in the development of vertical farming technologies.

I see a big opportunity for vertical farming for the production of healthy and sustainable food. However, I think it will never entirely replace conventional farming in fields. But vertical farming can and will play an essential role in food production in the future.

**More information:** S. Asseng et al, Implications of new technologies for future food supply systems, *The Journal of Agricultural Science* (2021). [DOI: 10.1017/S0021859621000836](https://doi.org/10.1017/S0021859621000836)

Senthold Asseng et al, Wheat yield potential in controlled-environment vertical farms, *Proceedings of the National Academy of Sciences* (2020). [DOI: 10.1073/pnas.2002655117](https://doi.org/10.1073/pnas.2002655117)

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