

ROKO Farming

Thinking upwards: vertical farming to be further developed into continuous production

ROKO Farming's novel technology is designed to produce fruit and vegetables worldwide all year round, while also freeing up areas for rewilding. This semi-automatic production method created by the Ulm-based business has huge future potential, as their success in innovation competitions demonstrates.

The four-square-metre structure in a hall in the city of Elchingen gives no indication that a new type of model for agriculture is being tested here. Is it just a vision - or is there more to it?

Brothers Philip and Sascha Rose from Ulm have lofty ambitions: counteracting climate change, species extinction and global hunger in an extremely targeted way. Their thought processes quickly led them to look upwards and consider vertical farming, i.e. growing plants in vertically stacked layers in a closed environment.

Huge savings potential and high quality

Vertical farming is already being used in some countries as an alternative to conventional agriculture. "This can save up to 300% of land," explains Philip Rose. Urban farming is currently attracting a lot of interest, especially in densely populated regions. But the two brothers are looking at completely different potential scenarios.



Philip and Sascha Rose. The founders of ROKO Farming want to transform food production completely and appeal to innovative farmers, gardeners, markets and commercial kitchens.

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Their idea? Harvesting crops continuously - without water wastage or excess fertiliser and with no pesticides. They envisage being able to do this anywhere, even in dry regions like Africa. One of the techniques that makes this possible is an automatic irrigation system that does not require soil: plant roots hang freely in the air and are sprayed with a nutrient solution. The plants absorb nutrients from the mist environment, and excess water is collected. This closed-loop, extremely resource-efficient method is called aeroponics: "We can save up to 95 percent water and 70 percent fertiliser. The nutrient solution contains a specially adjusted amount of fertiliser; each plant is given exactly what it needs," says bioengineer Philip Rose.

He knows exactly what these crucial parameters are for temperature, pH and electrical conductivity as well as artificial light. "We determine a range of values in which plants grow and produce healthy and tasty products." For the brothers, it's not pure speed that counts, but above all quality and taste. "Many plants can be cultivated in a system that is suitable for vegetables such as lettuce, basil, spinach, dill and spring onions." Strawberry and

potato plants, for example, have other requirements. The twin brothers have also identified an optimal nutrient solution for these plants - and have already harvested delicious strawberries. This type of production has many advantages, as industrial engineer Sascha Rose explains: "The produce is fresher than that sold in supermarkets. It's healthy and it tastes great. And no pesticides whatsoever are needed. But the yield is enormous." This is what ROKO Farming is all about: semi-automatic, continuous production on a small area.

From a simple tower to a continuous production plant

"Agriculture to feed the world's growing population is reaching its limits as the climate changes," explains Philip Rose. "Ever larger machines, more land, fertilisers and pesticides are being used, which is costly and causes high insect mortality around the globe." The two founders firmly believe that an alternative is urgently needed. "Methods to grow plants in beds stacked on top of each other are already available. However, some require a relatively large number of people to look after them, or are rather complicated, and others can only be operated with costly robotics. We were not at all convinced by these methods. We needed something that would enable continuous production." So the two engineers came up with the idea of combining three technologies: vertical farming, aeroponics and assembly line production.

The two brothers started brainstorming the idea in 2019, because they were planning to participate in the Ulm Innovation Competition crowdfunding campaign. The process and industrial engineers planned their first prototype, laid cables, built the assembly line system and programmed interfaces. Plant growth was optimised with artificial light, and values for the ideal ambient conditions in a closed environment were determined. What works on a small scale must also work on a large scale: winning the 2020 Berblingen Innovation Award and equity capital enabled the founders to construct their first pilot plant: a 2.5-metre-high module with a footprint of four square metres. "With this pilot plant, the two engineers were able to rotate 660 plants around a three-level pipe system and harvest vegetables on one level after the other – all this on an area that would correspond to 1,000 m² in conventional plant cultivation," says Philip Rose. And that's not the end of it. "The modules can be expanded in many ways."



ROKO Farming pilot plant: the sustainable method combines the advantages of vertical farming with those of aeroponics and process automation in order to harvest crop products sequentially in a modular and continuous system.
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An efficient semi-automatic system

What is the special feature of ROKO Farming? In addition to continuous production, the bioengineer highlights another major benefit: "The growing area is so compact and the plants so easily accessible that a single worker can put plants in one part of the system and harvest in another in one day's work. There is no need to walk through stationary racking systems and assess the growth of each plant." This is the benefit of automation: "In our analyses, we have programmed the parameters in such a way that we are able to achieve identical, optimal conditions for every plant, including controlling the LED light spectrum, climate control, irrigation and nutrient solution settings." The plants are sprayed with substrate solution for twelve seconds every twenty minutes. The only remaining non-automated steps involve putting plants where they are required and harvesting. So what stands in the way of making the system fully automated? "The costs of robots and automation for these two steps are huge. At the moment, higher profitability can be achieved when a worker goes in once a day to place the plants where they are required and harvest produce of consistent quality."

Incentives for innovative farmers, gardeners and markets

One of the brothers' particular concerns is rewilding areas that would otherwise be left as monocultures, thus impoverishing soils and depriving animals and plants of their habitats: "We want to create flower meadows and forests from the reclaimed areas." The brothers are allocating part of their profits to rewilding projects. It's all about sustainability. "With process optimisation and the specially set parameters, we've been able to take a big step towards energy and cost efficiency. Currently, the 0.25 euros per kWh cost of electricity in Germany is still a drawback. A subsidy for using our own electricity from a photovoltaic system would make the system more lucrative, and cost us 0.07 to 0.08 euros per kWh. Our plant production becomes holistically sustainable when ecologically generated electricity from photovoltaic or even biogas plants is used for LED lighting and air conditioning." Government incentives for farmers would help, for example through subsidies for rewilding projects and reducing transport distances through fresh, local production.

ROKO Farming is already attracting attention, not least when it won the Ulm regional cup in the Start-up BW Elevator Pitch competition, which secured their participation in the state finals. "We are hoping to talk to investors and sponsors, as well as innovative farmers and producers about producing food efficiently and sustainably." The potential for development is manifold, not only in terms of the almost unlimited, location-independent production of a wide range of plant varieties, but also in terms of expanding the existing pilot plant and use of renewable energy. An exciting prospect, especially given the increasingly difficult conditions in agriculture.

Article

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Further information

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