Can artificial intelligence already beat growers?

This year we launched the world’s first Autonomous Greenhouses Challenge, an international competition to improve food production using artificial intelligence and autonomous greenhouses.

The challenge is sponsored by Tencent and Tencent CXO David Wallerstein. In a preliminary round last spring, the number of international teams was reduced from fourteen to five. Since August these teams have been managing a real greenhouse in which they have to grow cucumbers autonomously using artificial intelligence with as little remote input as possible. Each team has been allocated a 100 m² greenhouse on our site. The teams are awarded points for different aspects: net profit from the cucumber crop, sustainability and the use of artificial intelligence. They will be judged by an independent jury.

The five remaining teams consist of AI and horticultural students and experts from organisations including Intel, Microsoft Research, Tencent, Delphy, AgroEnergy and universities. The teams are competing against a group of Dutch cucumber growers who are growing manually in a reference greenhouse.

Measuring leaf quality with hyperspectral sensor

It is important for growers to know how much reserves their crops have. At the moment this can only be measured by sending the leaves or fruits into a laboratory and waiting for the analysis.

We looked into whether it would be possible to directly measure the levels of sugars and starch, dry matter, chlorophyll and nutrients in the crop using hyperspectral cameras. Hyperspectral imaging provides a reflection spectrum of the incident light per pixel, combining chemometry and image analysis.

We looked at the visible and infrared spectrum, from 400 to 1700 nm. The results are promising: hyperspectral cameras can be used to determine concentrations of sugars in leaves and fruits, chlorophyll and dry matter percentage and leaf thickness. This makes it possible to adjust the climate or cultivation strategy based on these camera images.

Attracting native soil beneficials to enhance crop yields

The EU BioAttract project is a collaboration between Spanish and Dutch companies. Various enzymatic formulations have been developed in this project.

These formulations serve to attract local growth-promoting micro-organisms and liberate soil-bound nutrients. It is hoped that these effects will increase plant resilience and crop yields. Twenty enzymes and a number of root exudate compounds were screened in various crops. We chose five of these enzymes as candidates for the formulations. Some formulations were able to promote the growth of microorganisms such as Bacillus subtilis and Trichoderma sp. and reduce growth of Fusarium oxysporum and Rhizobium rhizogenes. We also found that enzymatic solutions without other additives were able to increase the phosphate uptake in tomato and melon plants, resulting in an increase in plant size and flower numbers.

New experiments are being set up to further develop other formulations in different compositions with the aim of alleviating abiotic stress and using them as seed coatings.

Excellent cucumber production in Chinese lean-to greenhouse

There are more than 1 million hectares of so-called “solar greenhouses” in China. These are greenhouses with walls that store solar radiation and give it off at night.

A consortium in which we are collaborating with the Ridder Group, Hoogendoorn, Ludvig Svensson and Delphy has built a Chinese solar greenhouse on our Bleiswijk site, with funding from the Netherlands Enterprise Agency and the Rotterdam The Hague Metropolitan Region. We want to demonstrate that major advances can be made in yields and quality using modern Dutch horticultural technology. The Bleiswijk solar greenhouse is equipped with a computer-control-