
Early warning system for greenhouse growers

In the past, a market gardener has always had to trust his own eyesight in order to know whether a plant is healthy or not. But now, in Dutch research greenhouses in Wageningen and Bleiswijk, high-tech machinery is taking over this job. TEXT RIK NIJLAND PHOTOGRAPHY WAGENINGEN UR

Have a look at this, it is really amazing.' Carolien Zijlstra shows pictures on her computer screen of a green pepper plant that has just been poisoned. On the left we see the plant by natural daylight, the way we would see it with the naked eye; on the right we see the images created by a fluorescence camera that is monitoring the plant's foliage. After 70 hours no change can be spotted with the naked eye, but the camera has unerringly detected a creeping deterioration: two leaves are gradually going black, a sign that photosynthesis, the plant's life-giving process, has ground to a halt. The lesson to be learned from these images is that a horticulturalist who wants an early warning that something is wrong with his plants should not rely exclusively on his own two eyes. Yet they are still the chief detection system for rooting out pests and diseases in greenhouses. In the early years of the twentieth century, agricultural extension services began to distribute booklets with drawings and watercolours to inform growers about threats to their crops such as fungal infections. And little has changed since then. The market gardener and his staff register whether there are insects sticking to the fly paper, or sound the alarm when they notice symptoms suggesting the presence of a mite, virus, worm or fungus on the plants. Systematically monitoring all the plants is a gargantuan task, certainly in the vast greenhouses of today. 'If a grower has to examine every leaf of every plant, it could take him two

weeks, by which time the disease will have overtaken him', says Zijlstra, a researcher at Plant Research International, part of Wageningen UR. 'Plant protection has not kept pace with the upscaling and innovation in greenhouse horticulture'. The result is that large-scale market gardeners are sometimes forced into preventive spraying to forestall problems.

NOSE SOUNDS THE ALARM

Meanwhile, new sensors have been installed in research greenhouses in Wageningen and Bleiswijk. So high-tech machinery is taking over – albeit still experimentally – the role of the eyes of the gardener or researcher in determining whether there are problems. One option is the fluorescence camera, but the researchers are also trying out another technology: the electronic nose, a machine that registers the volatile substances secreted by the plant. 'If the nose sounds the alarm, you still don't know exactly what the problem is', explains Zijlstra. 'The stress could be caused by a fungus infection, but it could also be caused by dehydration, for example.' Closer inspection, using a DNA test for example, can reveal within an hour or two whether an organism is the culprit. 'And then you can take steps at a very early stage, before there are any symptoms to be seen. For example, you can apply a plant protection product very locally.' Less pesticide use and therefore lower costs for the grower: it sounds great, but in practice there are some downsides, as became clear a

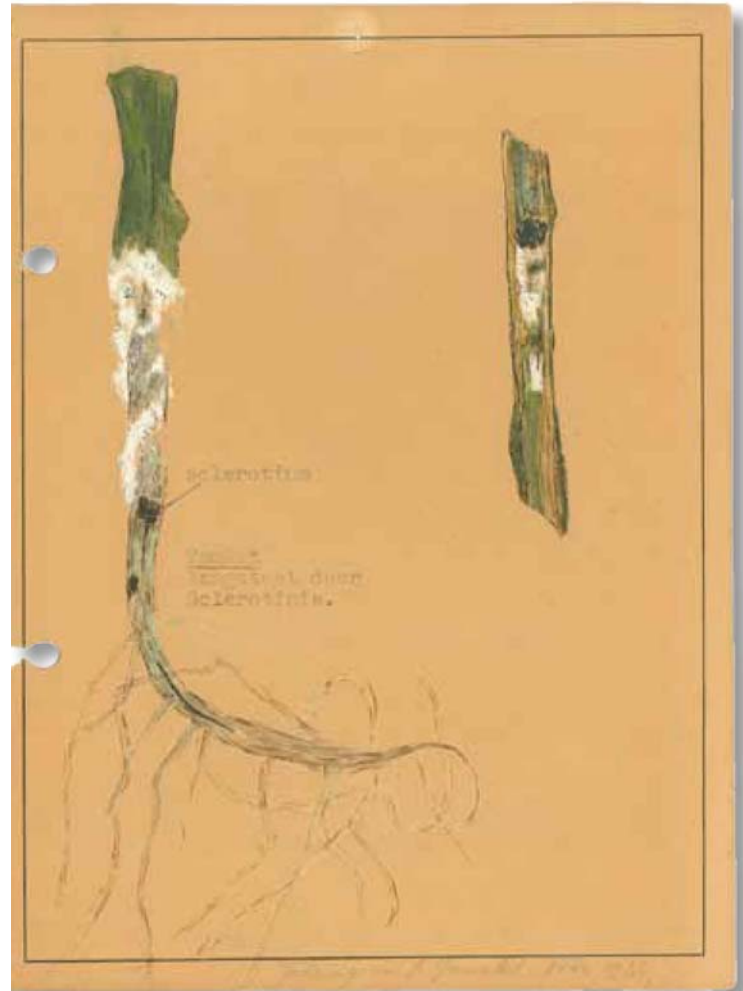
few years ago when sensitive detection tests were made available: when they detected pests and diseases early, market gardeners turned out to use more pesticides than ever, spraying at the slightest hint of a problem, perhaps needlessly.

To tackle this problem Zijlstra is leading a project called 'The Healthy Greenhouse', which started in April 2011 with funding of 10 million euros and 32 Dutch and German partners. Early detection is envisaged as one part of a comprehensive care system for plants. Zijlstra: 'Detection is not an isolated activity. As a grower you also need advice about what you should do with the information you get.' That is taken care of. 'I try to bring people together from a range of disciplines, and to forge the mix into a coherent whole.'

Zijlstra sketches a futuristic picture of what lies ahead: a robot that runs up and down between the rows of plants on a monorail. The robot is fitted with an electronic nose and/or a fluorescence metre, as well as a machine that can cut samples from the leaves, do a DNA test and send the results to the computer. If the computer decides on the basis of the data it receives that action is required, the precision sprinkler head on the robot is instructed to spray one or more plants, or perhaps even just a part of a plant. Zijlstra: 'The added value lies in this combination. Early detection is not worth anything if you don't know what to do with the knowledge it gives you.' ■

1934

These drawings of the Sclerotinia tomato fungus illustrated information for horticulturalists.



2011

Nowadays, high-tech apparatus monitors the health of greenhouse plants.

