Optimising the growth of strawberries under protection

It was appropriate that the 'Optimising Growth of Strawberries Under Protection' event took place on the sunny autumn day of 22 October when there wasn't a cloud in the sky; it has been the 'blue sky thinking' of scientists at the University of Hertfordshire that has led to the development of a new system that could help soft-fruit growers save £200 to £400/ha. Rachel Anderson reports.

Strawberries, powdery mildew and plant defence mechanisms

Members of the soft-fruit industry gathered at the University's picturesque, 40ha Bayfordbury campus and began their day listening to Dr Avice Hall MBE, of the Department of Biological and Environmental Sciences, discussing the perils of powdery mildew, which she described as being "the most feared disease in strawberries." She also discussed the research that she and her team have been carrying out on silicon, an element whose application to protected strawberry crops has been found to have many positive effects.

Dr Avice Hall MBE.

Avice explained that powdery mildew, which can potentially destroy up to 70% of a grower's strawberry crop, has become a problem in polytunnels because their warmer temperature and humidity levels make for an ideal environment for the disease's development. She warned growers that the disease arrives on plants from propagators and can also overwinter and be spread between cultivars, and tunnel to tunnel. In short, she advised growers that they should never think that they haven't got the disease.

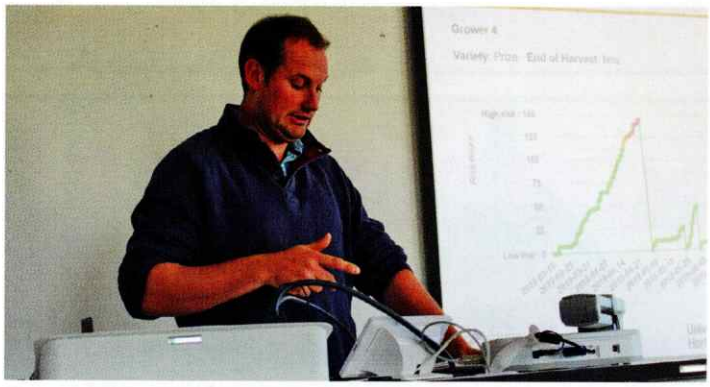
Fortunately, the situation is not all 'doom and gloom' as, explained Avice, plants have built-in defence pathways, both active and passive. Active resistance is a molecular, physiological response to infection involving the plant's resistance genes. This type of resistance is relatively easy for breeders to work with because it involves working with single or few genes, with very noticeable effects. However, "the pathogen gets so clever that it can then overcome the resistance," warned Avice. She therefore advocated plants' passive resistance, which includes structural features, such as the cuticle and cell wall thickness, that are already present in the plant. She asked: "How do these physical barriers work? In general, they make it physically more difficult for a germ tube, penetration peg, or insect stylus to get through the actual plant cell." Avice noted that, unfortunately, those characteristics that offer passive defence are often overlooked in breeding programmes. The focus tends to be on more popular traits, such as colour and sweetness. She added: "I think this passive type of resistance could provide a useful piece of armour against plant disease, particularly in strawberries." With this point in mind, she then went on to discuss the benefits of silicon for strawberry crops.

The benefits of silicon for strawberries

Avice and her team have been investigating the benefits of silicon since 2008, when they were asked by the industry, "Why is

there better disease control if potassium bicarbonate is applied with a silicon-based wetter?" Since then, the University of Hertfordshire team has been examining what happens to the strawberry plants when silicon is applied as a nutrient. Avice explained that silicon is an interesting element, as most of the silicon on the planet is not available for plant uptake, but plants benefit from its bio-available form. Silicon, the second most abundant element on the planet, has been proven to have many benefits, including improving plants' response to biotic stresses such as disease. Perhaps unsurprisingly, trials run by the University have found that the use of a silicon nutrient, whether applied as a spray or through the fertigation tubes, has "a real effect."

Happily, trials carried out on a commercial strawberry farm for five consecutive years showed that the silicon reduced the strawberry plants' susceptibility to strawberry powdery mildew. Avice confirmed: "Use in the fertigation tubes retards the start of an epidemic by eight to 12 days, and spraying gives a similar result." Moreover, an inadvertent result of the research, which has been supported by AHDB Horticulture and Orion Future Technology, has been the discovery that the average number of two-spotted spider mites in the crop was also reduced. This was possibly because the silicon made the plants' phytoliths too crunchy for the mites.



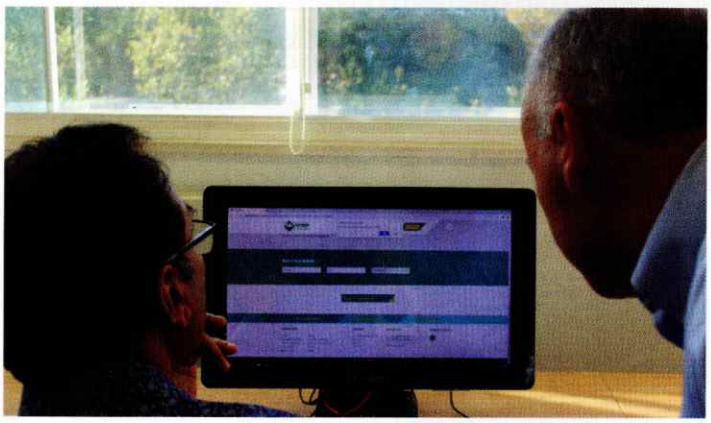
Richard Hibbard, soft-fruit production manager at EC Drummond

Avice concluded: "The use of bio-available silicon nutrient throughout the season enhances the passive defence pathway and so reduces susceptibility to powdery mildew and two-spotted spider mite." Furthermore, an experiment carried out on campus in hydroponically grown strawberry plants found evidence that silicon offers many other advantages to the crop, including increased biomass, increased numbers of runners, early flowering, increased chlorophyll, increased Brix and increased yield.

Avice concluded her presentation on silicon by advising growers to treat the element like a nutrient and should be given to the crop regularly throughout the growing season, preferably through the roots.

Strawberry Powdery Mildew prediction system

Having learned about the many positive effects of silicon application, growers were also no doubt pleased to learn that the team has developed a new, user-friendly decision-support system that can help them to control strawberry powdery mildew with fewer fungicide applications. The web-based system has steadily been in development since 2003/4, when the team first started plotting the number of disease-conducive hours that allow the



Above and below: Growers were given an interactive demonstration of the system at the event, which saw them try it out for themselves by inputting their own data into a computer.

fungus to grow. During 2018 and 2019, and with support from Ceres Trust, the system entered its final stage of development. This season it was validated on 10 commercial farms throughout the UK and is now available to purchase from Agri-Tech Services.

Avice revealed that the 'traffic light' prediction system sees sensors deployed in the crop to accumulate the hours in which the polytunnel's temperature and humidity levels offer the ideal conditions in which the fungus can grow. Once the tunnel has experienced 115 hours of these conditions, the green line on the graph displayed on the grower's smartphone or computer turns amber; at 125 hours, the line alerts growers that it is time to spray by turning red and, at 144 hours, the fungus can start to produce new spores, meaning that an epidemic will be initiated if the grower has not yet sprayed the crop. Avice explained: "After spraying, the grower enters the fungicide details and resets the system, which then starts to again accumulate disease-conducive hours."

Richard Hibbard, soft-fruit production manager at EC Drummond, revealed that 2019 was his third year of trialling the system. He noted that he trialled it on one field that received just 15 mildew sprays compared to the control field, which received 18 sprays. In fact, Avice pointed out that financial savings are