Towards the control of strawberry powdery mildew

Dr David Pennell reports

Strawberry powdery mildew remains a serious problem, especially now that a large proportion of the UK's crop is grown under protection. AHDB-supported work has sought to find ways of managing this disease, with some of the projects involving a team of researchers at the University of Hertfordshire led by Dr Avice Hall. Earlier this year the team held a full-day workshop at two venues - University of Hertfordshire, Bayfordbury Campus and the James Hutton Institute, Dundee.

From 2003/2004, Avice Hall had a grant from HDC to do basic work on controlling strawberry powdery mildew. In 2008, she discussed with growers Harriet and Henry Duncalfe, on whose farm the field trials were located, the observation that potassium bicarbonate gave better control if it was applied with a silicon wetter. Work with silicon and its effect on strawberries and powdery mildew was then started.

Dr Hall outlined the background to the work with silicon, which has been the subject of increasing research over the years, but with some inconsistent results. All plants need some silicon and it occurs in leaf hairs and other structural plant parts, but it has not been considered an essential nutrient. Silicon is the second most abundant element on earth, but most is in the form of sand and cannot be taken up by plants.

Some plants, such as rice, are said to be silicon accumulators, whilst others, like strawberries, are classed as non-accumulators. Much research has been done with rice and it is often stated that the silicon used must be 'bio-available' to the plant - being able to readily enter through the foliage or roots. Silicon is reported to have several effects in plants, such as cuticle-thickening and increasing the numbers of plant hairs on leaf surfaces. Physiological effects include modifying plant response to biotic and abiotic stress. The biotic effects include reducing the effect of plant diseases – such as powdery mildew on melon, and increasing disease and insect resistance, thus reducing susceptibility. Most research has used potassium silicate; however, it has some disadvantages, such as the silicate depositing in the fertigation tubes, and there are reports of it possibly causing albinism in strawberries (but this could be caused by the potassium).

The studies that Dr Avice Hall and her team carried out have used a source of silicon that does not contain potassium, namely Sirius' supplied by OrionFT. It is known to have good bio-availability and can be applied as a conventional spray or via fertigation systems. The University of Hertfordshire field trials have shown, over several years, that including Sirius in a weekly programme with fungicides has given good control of powdery mildew on strawberries. Trials also showed good suppression of two-spotted spider mite numbers. The use of the silicon nutrient, whether as a spray or in the fertigation tubes, gives reduced susceptibility to powdery mildew. The use through fertigation retards the start of the epidemic by 8 to 12 days, spraying gives a similar result. These results have been obtained for five consecutive years and are statistically significant, said Avice Hall.

Dr Avice Hall of the University of Hertfordshire.

She went on to explain how this effect was being achieved as plant structure is modified. Wax on the plant surface is modified and has phytoliths. The cuticle is thicker, with silicon deposited in the leaf cuticle, palisade layer and stomata. Silicon is deposited in the vascular tissue (xylem vessels) in the petiole, travelling up through the plant from the roots to the shoot in the vascular tissue. Impressive microscop images illustrated this very clearly.

Avice Hall said that, in 2017 field trials, silicon delivered through the fertigation tubes accumulated in the leaf and petiole, as in the glasshouse trial, but did not accumulate in the vascular tissue of the roots. Silicon moves through the plant by transpiration, and is deposited according to concentration, with most accumulation at the leaf surface and stomata.

But how does silicon reduce susceptibility to powdery mildew? Dr Hall's hypothesis is that the thicker cuticle, and thicker walls of the palisade cells, inhibit the penetration of the fungus, with the phytoliths on the surface inhibiting the formation of the fungal appressorium. All leaf hairs of plants contain silicon, and in some cases, the leaf hairs have been shown to play a part in physical disease resistance. Longer and more dense hairs may inhibit penetration by the germ tube of the fungus. Research elsewhere suggests that silicon may stimulate the plant's defence system, but the University of Hertfordshire has not investigated this in strawberries.

Using silicon in fertigation reduces the number of two-spotte spider mites, with strawberry leaf hair length and density increased. However, plants treated with silicon have thicker cuticles with phytoliths, and this inhibits the feeding of the two-spotted spider mites, inhibiting their reproduction and development. The use of the nutrient in the fertigation also raises the Brix levels of the petioles and fruit. The hypothesis is that the routine use of fungicides can inhibit the development o fungi used as biocontrol agents for invertebrates including two-spotted spider mites, allowing them to reproduce rapidly in the

presence of fungicides.

Silicon is likely to reduce susceptibility to other direct-penetrating plant pathogens such as powdery mildews and rusts, and to be beneficial to a range of crops. Its use through fertigation and in hydroponic production is likely to be particularly beneficial. It is less likely to be absorbed when applied as a spray, even though the dose is higher, and is probably not so efficiently transported round the plant. The University of Hertfordshire team is investigating this activity. Other possible benefits from the application of silicon include the stimulation of photosynthesis, resulting in the increased Brix. This is another strand of the ongoing research programme.

As silicon effects plant morphology, it needs to be given to the plant as a nutrient and, like other nutrients, it needs to be supplied regularly throughout the growing season, to ensure that new growth is reached. There are some negative indications from the use of silicon when applied as a spray, as silicon might have an adverse effect on pollinators, but Avice Hall said that they had not detected any such effects when applied via fertigation. Silicon could have an adverse effect on beneficial insects, which needs to be investigated. There have also been reports of toxicity from silicon in strawberries, but Dr Hall said that they had not seen any toxicity when the nutrient is used at the recommended rates. Literature suggests that albinism in strawberries is associated with excess potassium, not silicon.

Discussions between participants and researchers at the workshop in Hertfordshire showed that there is considerable interest in using silicon applications to strengthen crops' resilience against pest and disease threats, and a fascination as to how it is working in the plant. Silicon is likely to become an increasing part of IPM programmes, at least in strawberries. ◆

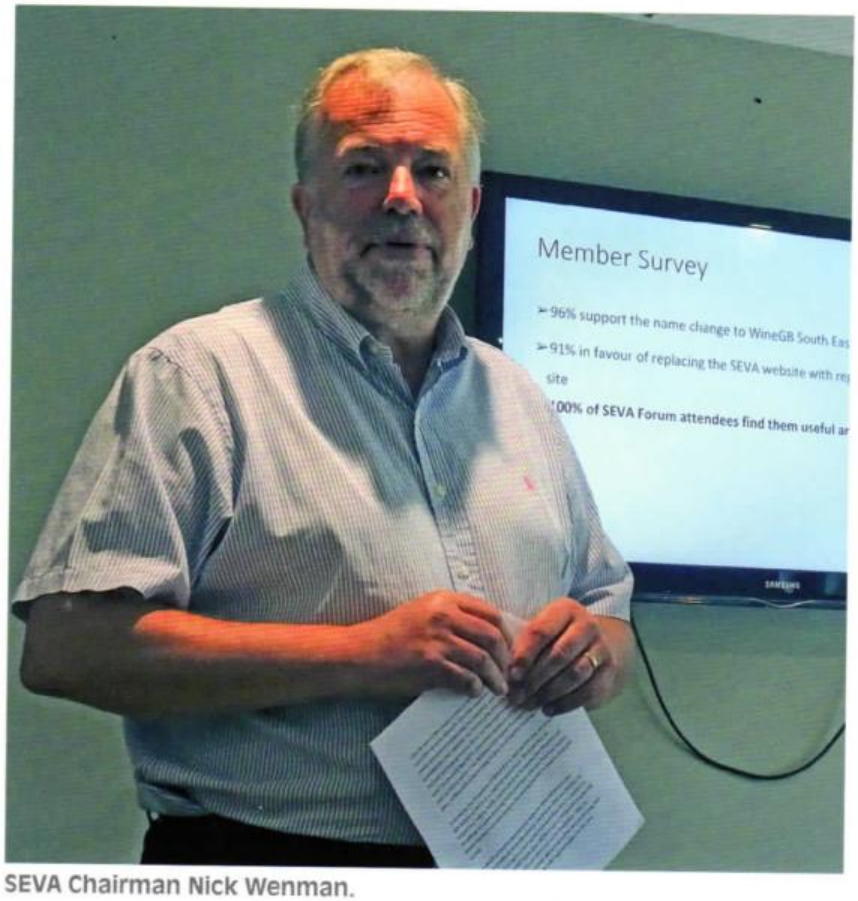
South East Vineyards Association (SEVA) AGM

by Joanna Wood

In his first year as SEVA Chairman, Nick Wenman, with his usual dynamism, has achieved many of the goals that he set out when he took over from Chris Foss in 2017.

At the AGM, hosted by the Bolney Wine Estate in West Sussex, Nick outlined progress and steered the meeting through some constitutional changes, including the name change to WineGB South East, which was passed unanimously. A presentation of the results of a member's survey showed support for a name change to be at 96%. As Nick pointed out, "SEVA isn't necessarily a brand in itself, and vineyards in Sussex, Kent and Surrey are developing their own brand identities". The survey also showed that 91% of members were in favour of the SEVA website being phased out and replaced by regional pages on the WineGB website. Kristina Studzinski, SEVA Deputy Chairman, and a lawyer before becoming a vine grower, led a group to review the constitution, and all the necessary changes were passed unanimously.

"So what's the future for SEVA?" asked Nick. His vision is that the sharing of information on viticulture, oenology and marketing will be important for future success, so that's what the regional associations will continue to do. "We will continue to organise formal and social forums to facilitate this. Personally, I would like to put more emphasis on marketing, especially wine tourism", said Nick. To give added value to members, the popular bi-monthly newsletters would be continued. There would be more emphasis on support for new and smaller vineyard owners and there must be an active recruitment drive, as a membership of 90 is far too small. Better communication with the WineGB press office was important and members were reminded to send through any 'good news' stories. The SEVA route map and mobile phone app had been well received, but in the light of all the changes, there would not be a reprint of the map as there will probably be a national scheme in future.



SEVA Chairman Nick Wenman.