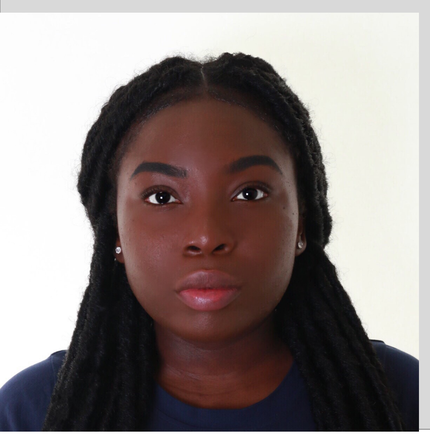
THE DEPOSITION OF SILICON LINKED TO THE REDUCTION IN SUSCEPTIBILITY TO STRAWBERRY POWDERY MILDEW



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Introduction

The most important disease of protected strawberries in the UK is strawberry powdery mildew caused by *Podosphaera aphanis,* which has to be controlled by the frequent use of fungicides (Dodgson, Hall & Jin 2016).

Work carried out at the University of Hertfordshire has shown that the weekly use of silicon nutrient in the fertigation tubes at a commercial strawberry farm results in reduced susceptibility to this disease.

Previous work at the university has also shown that the use of a silicon nutrient through a fertigation system enhances the constitutive defence mechanism of the plant.

Aim

To examine the effect of silicon nutrient applied in a silicon fertigation field trial through fortnightly disease assessment and the deposition of silicon in strawberry plants in a glasshouse in reducing strawberry powdery mildew.

Materials and methods

The silicon fertigation field trial had 6 treatments (table 1) and silicon was added twice weekly. Samples were collected fortnightly for disease assessments.

❖The silicon deposition experiment in the glasshouse had 12 treated and 12 untreated strawberry plants in a glasshouse. 0.017% silicon nutrient (as in the fertigation field trial) was delivered for 8 weeks into two ways; a). Through the root application. b). Hydroponically

❖Cross-sections of leaves, petioles and roots were stained with a fluorescence dye (Basic amine Lyso tracker yellow HCK -123), final concentration 1μM (Shetty et al.,2012).

❖Examination was conducted using a confocal microscope at x400 magnification and wavelength 450nm.

Results

Figure 1 and Table 1 shows the largest epidemic took place in the untreated and the silicon nutrient reduced the epidemic even in the absence of the fungicide. The results in figures 2-7 showed that in the leaf, silicon was found in the cuticle, epidermis, palisade layer, stomata and vascular tissue. In the petiole, the silicon was found in the epidermis and xylem and in the roots, the silicon was found in the xylem only.

The fluorescence intensity (Table 2) of the cross sections was quantified and this shows that the silicon was 5 times higher in the treated plants than the untreated. In addition, the silicon fertigation field trial has shown that plants with higher levels of silicon are less susceptible to the disease (Figure 1 and Table 1).

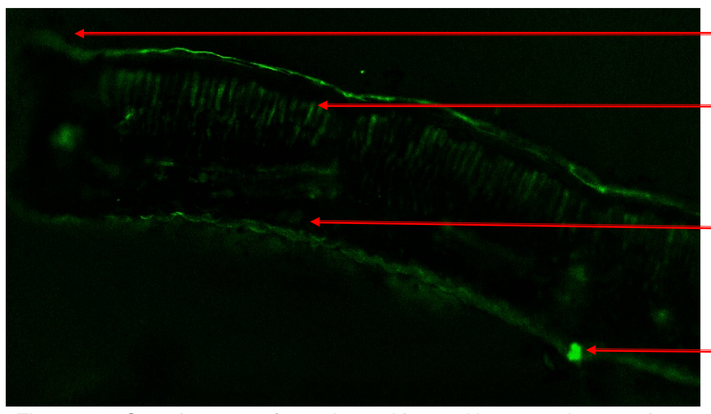

Figure 2; Strawberry leaf section with a silicon nutrient under a confocal microscope. Magnification x400.

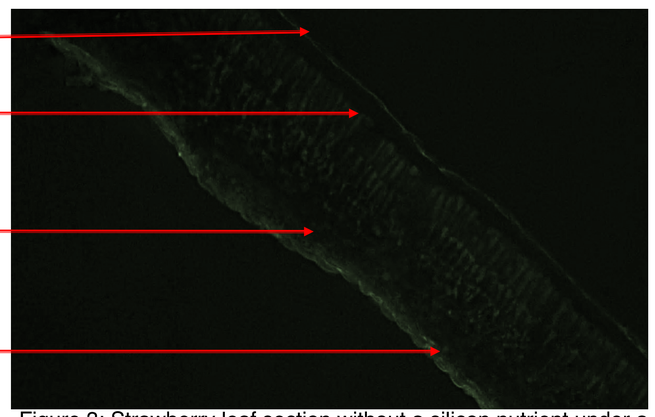

Figure 3; Strawberry leaf section without a silicon nutrient under a confocal microscope. Magnification x400.

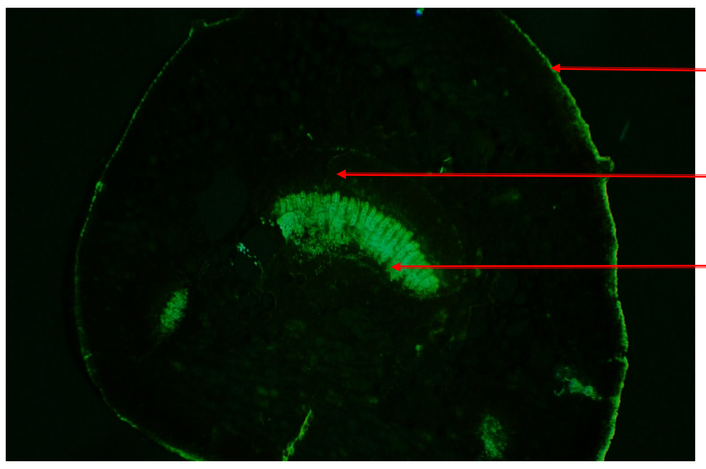

Figure 4; Strawberry petiole cross section with a silicon nutrient under a confocal microscope. Magnification x400.

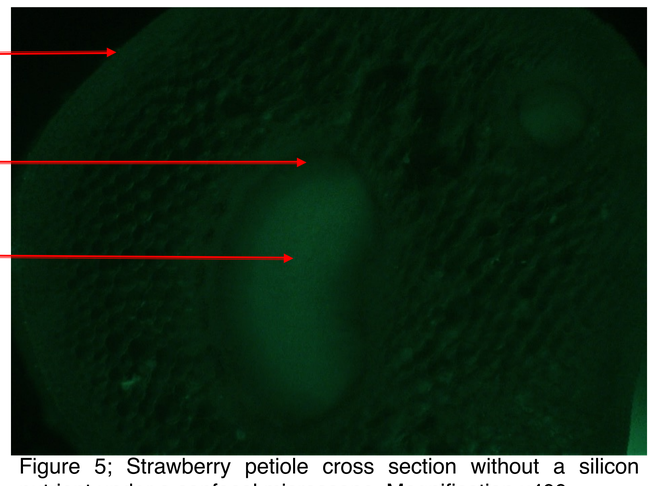

Figure 5; Strawberry petiole cross section without a silicon nutrient under a confocal microscope. Magnification x400.

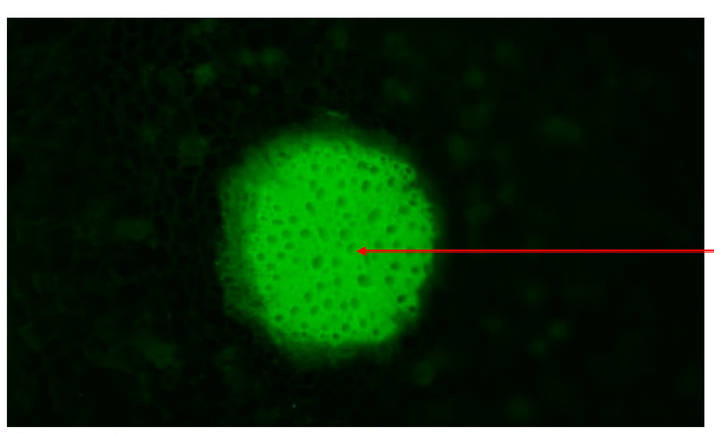

Figure 6; Strawberry root cross section with a silicon nutrient under a confocal microscope. Magnification x400.

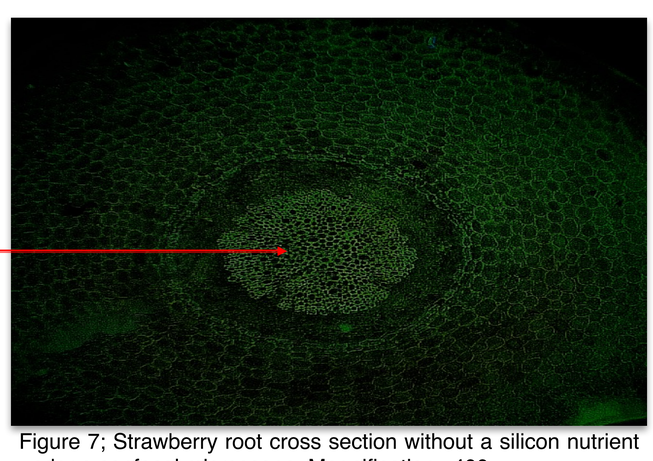

Figure 7; Strawberry root cross section without a silicon nutrient under a confocal microscope. Magnification x400.

Figure 1; Silicon fertigation field trial epidemic curve

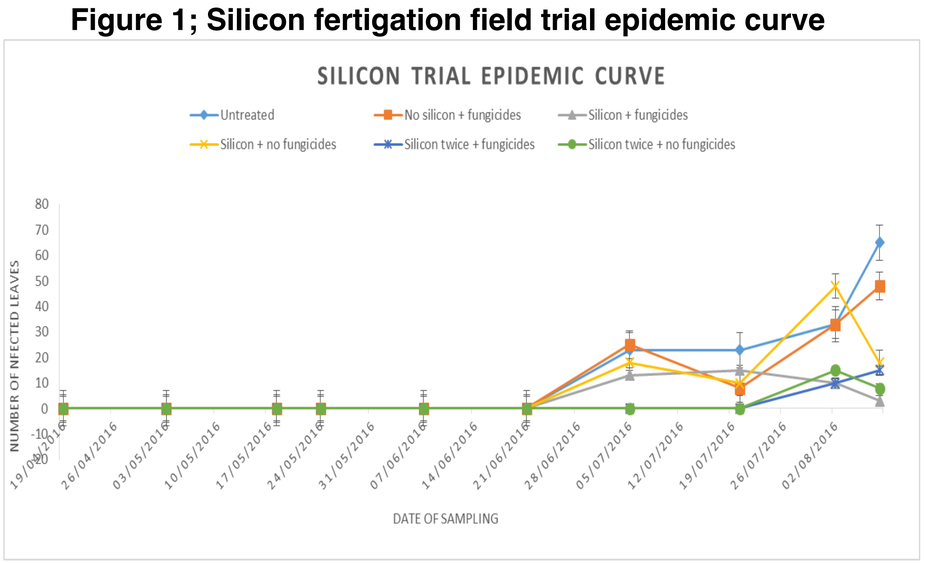

Table 1; Area under the disease progress curve (AUDPC)

Treatments	AUDPC
Untreated - no fungicides, no silicon nutrient	3,423
No silicon nutrient + fungicides	2,825
Silicon nutrient + fungicides	732
Silicon nutrient + no fungicides	1,610
Silicon nutrient twice + fungicides	410
Silicon nutrient twice without fungicides	375

Table 2; Fluorescence Integrated density

Cross- section	Untreated Fluorescence intensity	Treated Fluorescence intensity
Leaf	2.209cps	7.923cps
Petiole	1.913cps	7.770cps
Root	1.266cps	11.594cps

Discussion and conclusion

In the glasshouse experiment, treated plants showed that the silicon was found in the vascular tissue throughout the plant, in the leaf deposited in the epidermis, palisade layer and stomata, and in the xylem of the petiole and roots compared to untreated plants.

Additionally, in the silicon fertigation field trial there was more silicon in the treated than the untreated plants and level of silicon correlates with reduced disease susceptibility. This suggests that the addition of silicon nutrient through the fertigation fields enhances the constitutive defence mechanism of the plant.

Acknowledgement

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References

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