Factors contributing to sustainable strawberry production

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Introduction

In the UK, strawberry production is very intensive, which has been achieved over the last 20 years through the precise use of varieties, nutrients and polythene tunnels. Powdery mildew, *Podosphaera aphanis*, is a major fungal disease affecting strawberry production worldwide and can result in great yield losses. Work at UH has investigated the use of a silicon nutrient (Sirius) with and without potassium carbonate in a tank mixture to reduce disease severity. It has been shown that this form of silicon can significantly reduce disease severity (Jin et al., 2013).

The use of wild pollinators is another important feature of sustainable production. Insect pollinated crops accounted for 20% of UK cropland and 19% of total farmgate crop value in 2007. Most farms nowadays rely on buying in bees to help crop pollination, however, research showed that wild insects can be important pollinators to many crops and can provide more effective pollination service to certain particular crops than honeybees.

Aims

To identify factors that contribute to sustainable strawberry production, including:

- the use of silicon as a nutrient in contributing to delayed epidemic buildup compare with traditional fungicides;
- the role of wild insect pollination to tunnel grown strawberries, and how to encourage the presence of wild pollinators via sustainable farm management.

Silicon trial

Materials and methods

The field trial was set up in two commercial strawberry polythene tunnels in 'Blackberry Field' at Maltmas Farm, Wisbech in April, 2014. In each tunnel has five beds of cultivar J*****.

The silicon nutrient used was Sirius, applied twice a week at a concentration of 0.017% in the fertigation tubes. Four treatments were undertaken (Fig. 1 & 2).

75 leaf samples were taken per treatment bi-weekly from 20 May 2014. % cover of colonies (amount of mycelium) per leaflet and the number of colonies per leaf were then assessed in the lab.

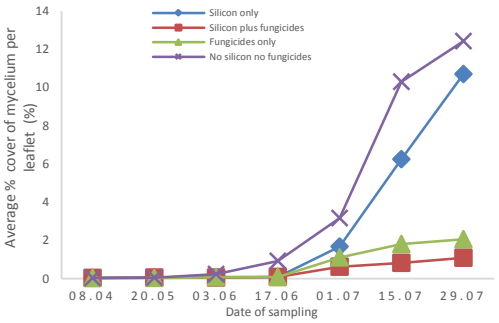

Fig. 1 Average % mycelium coverage per leaflet from Silicon only, Silicon plus fungicides, fungicides only and no silicon no fungicides treatments between 08.04.14 and 29.07.14.

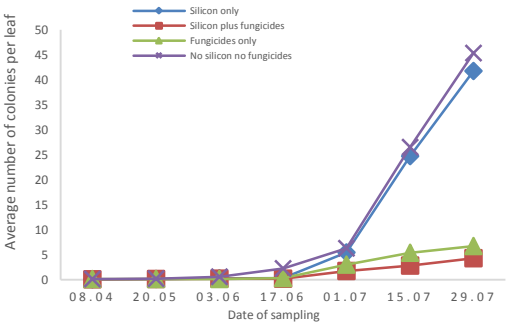

Fig. 2 Average numbers of powdery mildew colonies present per leaf from Silicon only, Silicon plus fungicides, fungicides only and no silicon no fungicides treatments between 08.04.14 and 29.07.14.

Results

Silicon only, fungicide only and fungicide plus silicon treatments have shown lower disease level compared'' to untreated (Fig 1). Silicon alone treatment also showed a certain level of disease reduction. Silicon plus fungicide treatment had both the lowest disease level and the lowest number of colonies present throughout the trial period (Fig 2).

Discussion

The results of the silicon trial indicated that silicon nutrient in the fertigation can improve fungicide action if used with commercial fungicides therefore result in better disease reduction.

This can benefit farmers as it will help to achieve a more efficient use of commercial fungicides, lead to the reduction of fungicide applications thus contribute to the sustainable production of strawberries.

Pollinator trial

Materials and methods

The pollinator survey was carried out bi-weekly for a two-day period each time starting from April 29, 2014 and include 9 surveys in total. Each individual survey was timed for a 30 minutes walk along the strawberry beds in the tunnel at a steady pace.

Five pollinator groups were recorded (Fig 3). Percentage of flowering, weather data, tunnel status and hours/time of the day covered by the survey was also recorded for each survey.

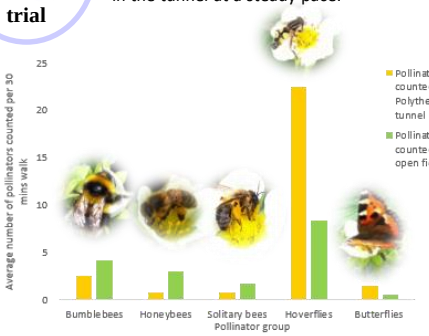

Fig. 3 Average number of pollinators from each group counted during a 30mins walk in the tunnel compare to the open field per two-day survey period from April to August 2014.

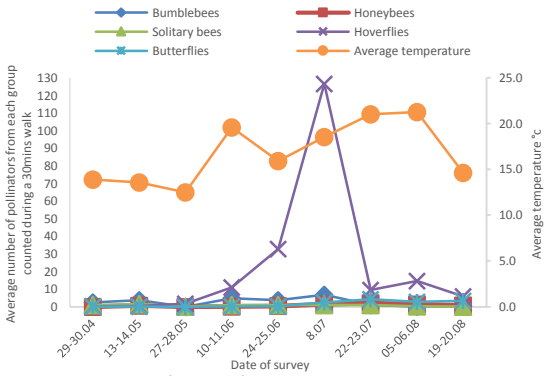

Fig. 4 Average number of pollinators from each group counted during a 30mins walk in relation to the average temperature (orange line) recorded per walk on each survey period between 29-30.04.14 and 19-20.08.14.

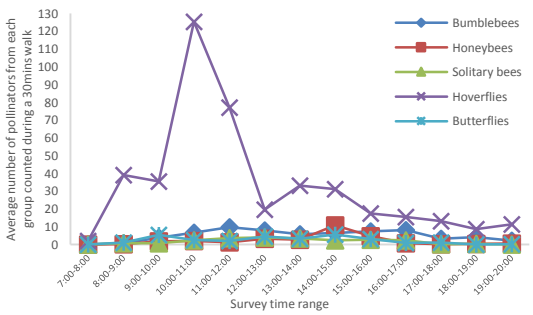

Fig. 5 Average number of pollinators from each group counted during a 30mins walk at different time of day per two-day survey period from April to August 2014.

Results

Hoverflies and Bumblebees are the main strawberry pollinators at Maltmas Farm. Hoverflies were found to be more abundant in the tunnel than in the open field (Fig. 3). Their number remained relatively stable and reached at a peak in July (Fig.4). Temperature between 15°C and 22°C were found to encourage the pollination activity.

Pollinators were found to be most abundant between 10am and 4pm from April to August. Hoverflies were present from as early as 7am till 8pm with the most active period between 10am and 12pm. The active level of bumblebees decreased before 10am and after 5pm while honeybees reached at a peak between 2pm and 3pm (Fig 5).

Discussion

Compared to honeybees, wild pollinators including hoverflies, bumblebees and solitary bees are the main pollinators of commercial strawberries at Maltmas Farm. Hoverflies are found to be the most active pollinator group. The presence of wild pollinators remained relative stable in the tunnel environment throughout the crop season. Since Maltmas farm only relies on wild pollinators to provide pollination to their crops, it is important to improve farmland management to provide a favourable habitat to wild pollinators.

In the meantime, since pollinators are well known for their ability to carry microscopic particles, whether this could lead to the transmitting of powdery mildew fungus spores from infected flowers during the pollinating process could be further investigated.

Future work

- To continue investigate the use of silicon nutrient in reducing disease severity and how this contribute to sustainable use of fungicides;
- To investigate the role of silicon nutrient in strawberry pest control and whether it can help to reduce the use of pesticides.
- To investigate the efficiency of strawberry pollination by wild pollinators in the tunnel; to demonstrate the importance of wild pollinators to sustainable strawberry production and to discover ways of stimulating the presence of wild pollinators via sustainable farmland management.
- To investigate whether the pollination activity could play a role in spreading strawberry powdery mildew disease.

Acknowledgement

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References

Jin, X. L., Fitt, D. L., Hall, A. M. & Huang, Y. J. (2013) The role of chasmothecia in the initiation of epidemics of powdery mildew (*Podospheara aphanis*) and the role of silicon in controlling the epidemics on strawberry. Aspects of Applied Biology (119): 151-153.