Use of a Real-Time Decision Support System to give accurate timings for fungicide applications

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INTRODUCTION

Strawberry powdery mildew is a serious disease of the strawberry crop in the UK, caused by the fungus *Podosphaera aphanis.* An infection can result in yield losses of 20-70%, resulting in £56 million losses at 20%. Symptoms include leaf cupping, red blotches and white mycelium on the leaves, petioles, flowers and/or fruits (Fig. 1).

Temperature and relative humidity (RH) were found to affect strawberry powdery mildew disease development. A rule-based prediction system was devised recording the accumulated number of hours (144) of the suitable temperature and RH necessary for the fungus to germinate, grow and produce spores. For germination: RH >60%, temperature 15.5-30ºC; with optimum temperature for growth 18-30ºC. When both parameters are satisfied, this identifies high risk periods when sporulation may occur, thus allows growers to spray fungicide at the optimal time to prevent primary infection.[1]

In order for the prediction system to be more widely adopted, it needs to effectively record the number of disease conducive hours to guide growers to control the disease, be trusted by growers and easy to use.

Aim: To validate a prediction system to determine whether its use can reduce fungicide applications as compared to a farm's routine spray programme, whilst maintaining commercially satisfactory control of strawberry powdery mildew.

Fig. 1: *P. aphanis* mycelium on a ripe strawberry

MATERIALS & METHODS

Validation in 2018 of the web-based real-time prediction system was conducted at a farm in Ross on Wye, England from April to September. In several tunnels (2.8 ha) fungicide applications were performed according to the system. This was compared to a control field (7.29 ha) containing the same strawberry variety (Prize (ever bearer)), but was sprayed according to the routine spray programme. Leaves (100 approx.) were assessed for mycelium monthly, giving the total disease level across the sample and percentage disease cover using an assessment key.

The prediction system was used by the growers, who checked the system daily to decide when a fungicide spray was needed. When using the system, green suggests low risk of fungus sporulation, based on the low number of accumulated disease conducive hours, up to 115 hours; amber then indicates to the grower that they should prepare to spray; at 125 disease conducive hours, red represents when sporulation is likely to occur. Fungicide was often applied when the system gave an amber/ red warning; once a fungicide was applied, the system was reset (Fig. 2).

Parameters analysed: Disease assessment; number of fungicide applications and modes of action used; cost-benefit analysis and usability of system.

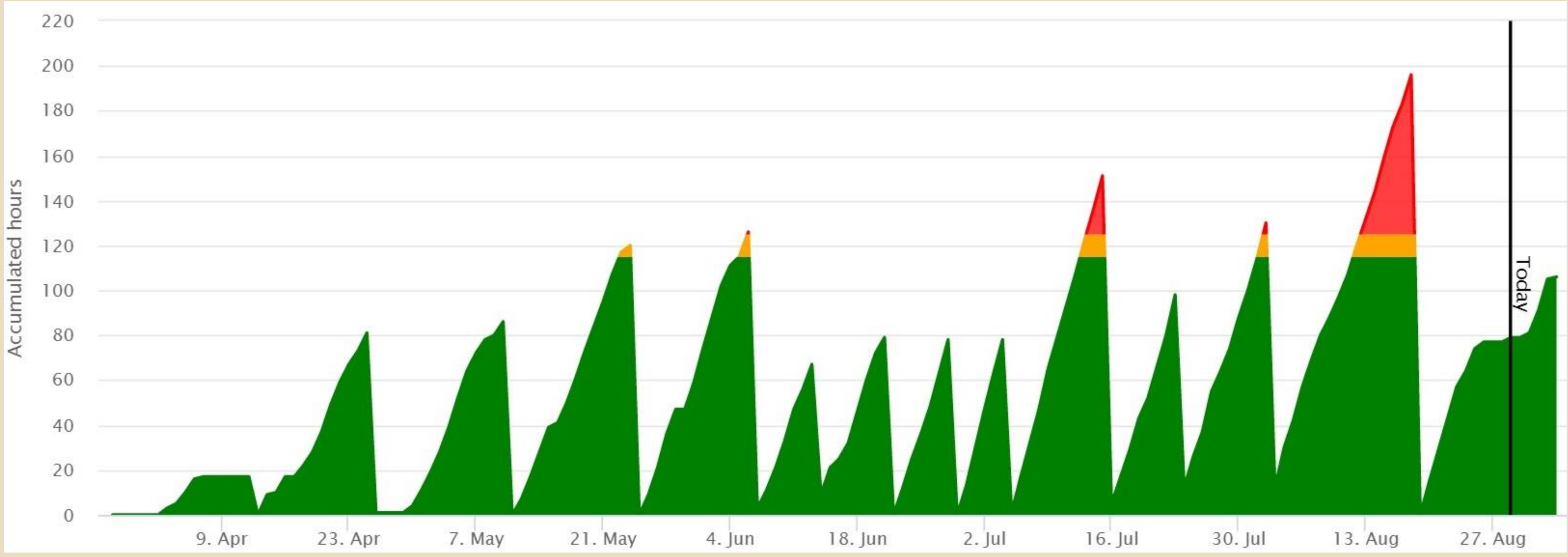

Fig. 2: Web-based prediction system graph used by grower in Ross on Wye, England (2018). Peaks on the graph show where hours have accumulated under disease conducive conditions (temperature: 15.5-30ºC & RH: >60%). When fungicide spray is applied, accumulated hours is reset to 0.

- Green: No action required
- Yellow/ Amber: Fungicides should be applied (115-125 accumulated hours)
- Red: 125+ accumulated hours, sporulation likely to occur

RESULTS

- The weather conditions were not very conducive to disease development, <5% disease level was found on collected samples
- Use of the prediction system provided commercially satisfactory control of strawberry powdery mildew
- Fewer fungicide applications were used in the prediction system (19) trial field than the control field (23)
- The grower suggested the prediction system gave better management of fungicide modes of action
- Over £200 per hectare was saved using the prediction system, due to reduced fungicide usage and labour costs
- The prediction system was user-friendly; the grower successfully utilised the prediction system to support the management of fungicide applications (Fig. 2)

FUTURE WORK

In the 2019 season the prediction system is continuing to be validated and used on 8 farm sites across the UK, six in England and two in Scotland. The web-based prediction system is now being delivered by a new provider (Fig. 3).

Effects on disease control, number of fungicide applications and mode of actions used will again be assessed. Growers will also discuss the usability of the system and how it was used. Cost benefit analyses for all farms will be calculated.

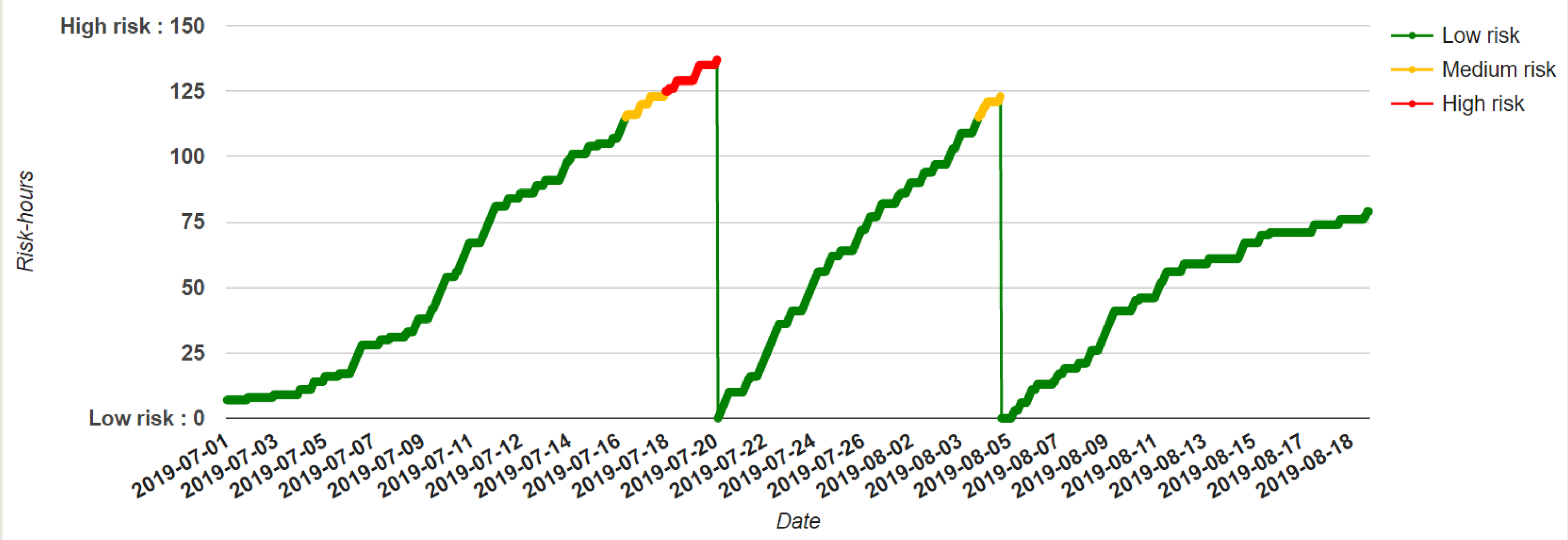

Fig. 3: Prediction system (2019) from one trial farm, as observed by the grower on the web-based platform, as part of on-going validation of the system.

DISCUSSION

By using the web-based real-time prediction system as a decision support system the grower was able to use fewer fungicide applications whilst maintaining control of the disease.

Therefore, reducing the potential for fungicide residues on the fruit, which is in the consumers interest. By using less fungicide applications and fewer modes of action of those applied; the selection pressure on the fungus is reduced, consequently, decreasing the risk of fungicide resistance.

The use of the prediction system enables the grower to spray with precision, therefore, maximising fungicide effectivity on disease control, whilst reducing associated costs.

REFERENCES

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[2] Liu B. and Hall A.M, (2013) Practical experience of using a prediction system to control strawberry powdery mildew. Aspects of Applied Biology. 119, 227-232.

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