Grower Summary

SF 114

Development of temperature degree-day based models to predict pest development on strawberry for optimisation of control strategies

Final 2013

The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Project Number:	SF 114
Project Title:	Development of temperature degree-day based models to predict pest development on strawberry for optimisation of control strategies
Project Leader:	Professor Xiangming Xu
Contractor:	East Malling Research
Industry Representative:	Mrs Harriet Duncalfe
Report:	Final Report 2013
Publication Date:	20 May 2013
Previous report/(s):	Annual Reports 2011 and 2012
Start Date:	01 April 2010
End Date:	31 March 2013
Project Cost:	£78,993

Headline

- Models have been developed for predicting the timing of development of European tarnished plant bug (*Lygus rugulipennis*), strawberry blossom weevil (*Anthonomus rubi*) and strawberry tarsonemid mite (*Phytonemus pallidus* ssp. *Fragariae*)

Background and expected deliverables

Strawberries are very susceptible to many pests and diseases, many of which cannot currently be effectively controlled by non-pesticidal means. These include *Botrytis*, powdery mildew, black spot, European tarnished plant bug, strawberry blossom weevil, western flower thrips, aphids and tarsonemid mite. Correct timing/targeting of control strategies, and decisions on whether intervention is needed based on interpretation of pest monitoring or pest thresholds, depend on our understanding of pest development in relation to climatic conditions. Some developmental stages of pests may be more susceptible to insecticides than others; information on when the most susceptible stages are present would enable more effective pesticide targeting. For pests in general (unlike diseases), the developmental rate is mostly related to temperature; mathematical models are used to describe such temperature-developmental-rate relationships. These relationships will be different for different insect and mite species.

Diapausing adults of European tarnished plant bugs (capsids) overwinter on weeds or crop debris. Overwinter mortality is high, so low numbers of individuals are normally present early in the year. The first generation of the pest produced by the overwintered adults develops on weeds, and adults from this generation disperse into strawberry where a second (and possibly a third) generation occurs. The dispersal into strawberry has generally been at the time of flowering of everbearer strawberries. Capsids feeding on developing fruits cause the typical 'cat face' damage seen on everbearer strawberries. Recent observations, however, suggest that capsids may disperse to and cause damage to many other crops, including June-bearerer strawberry, raspberry and blackberry, at much earlier times than previously reported, possibly because of warm winters and springs. An understanding of the rates of development of capsids in weeds in early spring would enable growers to predict when the dispersal of first generation adults is likely to occur, and would aid in timing of placement of pheromone traps and in decisions on pesticide application timing.

Forecasting models for *Botrytis* and powdery mildew have been developed and implemented as a computer programme (in HortLink project HL0191). The project focused on the development of a holistic Integrated Pest and Disease Management system for production of strawberries which does not rely on intensive use of fungicides and insecticides during flowering and fruit development. The research work on pests in this HortLink project focused on developing alternative non-pesticidal control methods. The use of forecasting models for pests would increase the understanding of when they are likely to arrive in crops and how quickly they will develop when there. It may also be possible to use this information to develop treatment thresholds for the pest. In a current HortLink project HL01107, a model for predicting western flower thrips development is already being developed.

In this project (SF 114) the aim was to develop phenological models for capsids, strawberry blossom weevil and tarsonemid mite on strawberry and to validate the capsid model with field-collected data.

Summary of the project and main conclusions

We have developed prediction models for three strawberry pests (capsid, strawberry blossom weevil and tarsonemid mite) and incorporated them into a computer programme that already contains models for strawberry grey mould, powdery mildew and western flower thrips. New data were obtained in laboratory experiments by studying capsid development under fluctuating low temperatures to incorporate into the capsid model. To evaluate the capsid model, capsid numbers were monitored in 2010 and 2011 under both open-field and protected conditions, on weeds and strawberry plants. Predicted capsid population patterns from the model agreed well with the observed data. Thus, the capsid model can be used in practice to assist growers in managing this pest. Running the model will enable growers to identify the timing of first generation capsid adult dispersal into strawberry, or other crops, from weeds. This will aid in timing the deployment of pheromone traps to monitor populations in the crop and make it possible to target applications of insecticides against the pest. Validation of the models developed for strawberry blossom weevil and tarsonemid mite was not part of this current project; field validation will be needed before these models can be used by growers.

Financial benefits

Lygus rugulipennis (European tarnished plant bug) is a serious pest on everbearer strawberries causing crop losses by feeding on developing fruits which become deformed and unmarketable. Over 50% of fruit may be downgraded as a result of capsid feeding in unsprayed crops. The predictions made by the capsid model developed in this project agreed well with observed catches in pheromone traps and in sweep and tap sampling on plants throughout the growing season. Thus the use of the model will enable growers to make decisions on whether intervention is needed based on interpretation of pest monitoring and pheromone trap catches, and to apply control strategies to accurately target this pest. In addition, different developmental stages of capsids may be more susceptible to some insecticides than others; information from the model on when these susceptible stages will be present will improve control of the pest. Thus the use of the capsid model should enable growers to make savings in insecticide applications against this damaging pest.

Action points for growers

- Growers should initially run the capsid forecasting model (and models for other pests and diseases) to gain an understanding of their use without using the forecasts for making decisions on management strategies.

- Once they have gained sufficient confidence in the use of the model, they may use the forecasts to inform their decision making.