Grower Summary

TF 189

Optimum treatment timing to reduce overwintering codling moth populations

Final 2011

Disclaimer

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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HDC is a division of the Agriculture and Horticulture Development Board.

Project Number:	TF 189
Project Title:	Optimum treatment timing to reduce overwintering codling moth populations
Project Leader:	Prof. Jerry Cross
Contractor:	East Malling Research
Industry Representative:	Colin Corfield, Owl House Fruit Farm & Paul Bennett, Agrovista Ltd
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Project Cost:	£ 24,477

Headline

- Use pheromone traps, egg monitoring and a temperature based forecasting model for timing codling moth sprays and focus on good control of the 1st generation in June and July to minimise population carry over to the next year.

Background and expected deliverables

Codling moth is still the most important apple pest in the UK. Despite regular use of insecticides through the season to control it and prevent the damage the larvae cause, populations persist from year to year to give rise to new attacks. Work is required to study the egg-laying dynamics of codling moth through the season in relation to pheromone trap catches and forecasts by the RIMpro-Cydia model, to find when treatments are best applied to reduce overwintering populations. The results should guide control strategies for long-term reduction of moth numbers.

Summary of the project and main conclusions

The seasonal dynamics of codling moth were studied in two unsprayed areas (each of ~200 trees) in infested apple orchards near Faversham and Lamberhurst, Kent. Two standard sex pheromone baited delta traps were used to monitor males and two pear ester kairomone (DA2313) bated delta traps to monitor males and females (early May to mid-October). Each week, a count was made of the codling moth eggs and larvae on 300-500 fruit clusters per orchard. The approximate date of egg hatch for each larva collected was back-calculated from temperature records. Larvae migrating to pupation sites were monitored from mid-May to September at fortnightly intervals using corrugated cardboard bands around the tree trunks. Pupation success was quantified to determine contributions to the infestation the following year. The usefulness and accuracy of the RIMpro-Cydia computer based codling moth forecasting model were investigated.

Seasonal dynamics of codling moth and targeting of sprays

- There was a strong 1st codling moth generation between mid-May and end of July and a weak incomplete 2nd generation between early August and September or early October at both sites in both years.

- Temperature sum calculations indicate that only those individuals completing their 1st generation development and laying eggs before the end of July have any chance of completing a 2nd generation in the same year. In 2009 and 2010 the proportion of the population that did this was zero.

- 1st generation eggs laid after the end of July did not complete their development. Thus, the 2nd generation, though damaging to the crop, does not complete its development or contribute to the following year's population.

Sex pheromone traps

- This study confirms that sex pheromone traps should not be relied on solely for monitoring codling moth populations and timing sprays. They gave a broad indication of the periods of codling moth activity, but could not be used to predict the occurrence of eggs in any qualitative or quantitative way.

- Early catches of 1st generation males preceded the first appearance of eggs by 4-5 weeks in 2009 but by less than two weeks in 2010.

- Importantly, the ratio between the numbers of male moths caught in the sex pheromone traps and the numbers of eggs found on fruits in the two orchards over the two years varied greatly and was highly inconsistent. For the 1st generation, the ratios were 93:37, 88:13, 110:237 and 138:19 for the two orchards in the two years, respectively. Furthermore, the pheromone traps scarcely indicated the 2nd generation flights and attacks. For the 2nd generation, the ratios of males to eggs were 4:11, 9:0, 7:122 and 14:6 for the two orchards over the two years, respectively. At best only a few moths were captured in August and September, even at one site (Teynham) in 2010 where a heavy 2nd generation attack occurred.

- Based on the UK data provided by this study, if pheromone traps were to be relied on, a much lower threshold, say of two moths per trap per week, would need to be adopted for the 2nd generation which can be very damaging as the fruit is ripening and becoming more susceptible to attack and larval penetration.

- Sex pheromone traps are relatively quick and easy to use and do give valuable information on the general occurrence of the pest, including flight periods and activity,

but catches need to be interpreted with care and in conjunction with other monitoring and forecasting methods. If relied on alone with the existing low threshold of 5 moths per trap per week and perhaps a lower threshold of two moths per trap per week for the 2nd generation, excessive and not very well targeted application of sprays is likely to result, which will do an adequate job but often at higher cost than necessary. In addition, the reduction in the carryover of the population to the following year will not be optimised.

Pear ester traps

- The pear ester kairomone traps performed rather similarly to the sex pheromone traps in terms of capture of 1st generation males, though numbers of males captured in the pear ester traps were much lower than captures in the sex pheromone traps; also the peaks and troughs of capture with the two trapping methods did not coincide. The start of 1st generation pear ester trap catches were a week or two later than the sex pheromone trap catches, probably due to reduced attractiveness. The pear ester traps did not give any indication of the 2nd generation (of males or females) and this was a serious failing.

- The main advantage of the pear ester traps is that they capture females, though numbers captured in this study were small and erratic, and no 2nd generation females were caught at all. The catches of females did roughly coincide with the periods of egg-laying, but the erratic nature and small size of the catches could not be relied on to give a clear indication of the times of egg laying or of the numbers of eggs. Again there was no consistent ratio between the numbers of females captured and the numbers of eggs. The moths are easy to sex by the presence of a characteristic dark patch on the undersides of the forewing of males which is absent in the females.

- The failure to catch 2nd generation females was probably due to a lack of attractiveness of the pear ester lures and increasing competition with the volatiles that were produced by the fruits as they ripened. The use of the pear ester traps is worthy of further investigation but this study did not indicate their use would make a substantial contribution to improving codling moth monitoring.

Egg monitoring

- Regular, direct counting of eggs on fruitlets *in situ* is currently probably the only fully reliable and accurate way of determining the timing and need for sprays against codling moth.

- Direct egg monitoring is time consuming and requires diligence and good eye sight, but is not difficult.

- Observations ideally would need to be done weekly with a sample size of ideally at least 600 fruitlets per orchard per sampling occasion. Targeting the sampling to where codling moth damage is most likely to occur on fruits exposed to sunshine at the top of the tree will markedly improve efficiency. The sample size could be reduced when egg numbers are high.

- The time required to examine 600 fruitlets is at least an hour, so such sampling is costly. However, codling moth control is probably costing growers at least £300 per ha per season and better targeting and timing of sprays might reduce this by at least £100 per ha per season, so investment in egg monitoring is justified.

Forecasting models

- In view of the limited value of the information provided by sex pheromone trap monitoring, computer based phenological simulation models are an important source of information for interpreting the seasonal dynamics of codling moth.

- The RIMpro-Cydia model is the most sophisticated model available. It did give broadly correct predictions of the 1st generation seasonal dynamics, taking into account well established day-degree air temperature sums > 10 °C as well as dusk temperatures > 10 °C which are known to be important for egg laying activity.

- However, the RIMpro-Cydia model failed to predict the occurrence of the 2nd generation attack in both years, a particularly serious failing at Teynham in 2010, where large numbers of eggs were laid throughout August and into September which resulted in a significant larval attack. Temperature based models are sensitive to air

temperatures and the accuracy of grower operated weather stations needs to be scrutinised

Control tactics

- The seasonal dynamics of codling moth in the UK has implications for control tactics. Control measures to maximise the reduction of the carry over of the populations to the following season and avoid the development of resistance should focus on control of the 1st generation.

- A high standard of control thus needs to be maintained throughout June and July. During this period it is important to use a range of insecticides with different modes of action to minimise the risk of resistance development.

- Use of codling moth granulovirus as part of the strategy against the 1st generation is important. Some UK growers may be under the misapprehension that codling moth is widely resistant to the virus, based on reports of resistance from Europe. This is not the case. The virus is important because it acts biologically and can persist in the population from one season to the next, contributing to long-term population suppression.

- Control of the 2nd generation must not be neglected as significant numbers of eggs can be laid throughout August and September and the ripening fruit is very susceptible to attack. Protection needs to be maintained throughout August and the first half of September.

- It is regrettable that no high dose sex pheromone mating disruption (MD) system is approved for use in the UK, to complement the good range of chemical control options. The Exosex autoconfusion system is the only codling moth MD system approved for use in the UK currently. Fostering the registration of other MD systems which are widely used throughout Europe (through the mutual recognition route) should be a priority for the HDC.

Financial benefits

The timing of insecticidal sprays against codling moth is crucial for the limitation of damage to the crop. Better timing will result in a higher yield and a more effective use of the plant protection product used.

Action points for growers

- Do not rely solely on sex pheromone traps for codling moth monitoring. Monitor eggs at least fortnightly in orchards at risk (with a history of infestation).

- Use temperature based forecasting models (such as the RIMpro-Cydia model) to give supplementary information on the seasonal dynamics of the moth especially to identify periods where dusk temperature are >15 °C.

- Make sure that temperature data on which predictions are based is obtained from properly calibrated met stations, ideally cited in local orchards at risk.

- Control measures should focus on control of the 1st generation. They should aim to maximise the reduction of the carry-over of the populations to the following season and avoid the development of resistance..

- A high standard of control needs to be maintained throughout June and July. During this period it is important to use a range of insecticides with different modes of action to minimise the risk of resistance development. Insecticides generally give 2-3 weeks protection, shorter intervals occurring in warmer weather.

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