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GROWER SUMMARY

Headline

Codling moth sex pheromone trap thresholds may need adjusting and simplifying

Background and deliverables

Codling moth is the most important pest of apples and also an important pest of pears in the UK. Most insecticide sprays on apple are used against it. Control is usually good, but populations are not being reduced to such low levels that spraying is reduced in subsequent years: growers are on an insecticide treadmill. UK growers generally rely on pheromone traps to decide if and when to spray for codling moth but previous work in project TF189 suggested that they are of limited benefit and growers may not be making best use of their time and effort in using them. Experience in the NL indicates that as good or better control of codling moth can be obtained using development and population simulations given by the RIMpro-Cydia model using data from local meteorological stations. The model, which is available to all growers, takes into account when conditions suitable for egg laying occur (dusk temperatures > 15 °C) as well as maturity and longevity of females rather than activity of males as indicated by sex pheromone trap catches. This work will determine which of the three alternative decision-making methods is best leading to improvements in control and/or savings in monitoring costs and management time.

Summary of the project and main conclusions

In 2012, the first year of a three year experiment, three methods of timing insecticide sprays for codling moth were compared each in three commercial orchards in Kent:

- Method 1 ‘Trap’: Standard method of monitoring male moth flight using pheromone traps and spraying after a threshold of > 5 moths for 2 weeks is exceeded.

- Method 2 ‘RimPro+trap’: Use of the RIMpro-Cydia forecasting model in conjunction with pheromone trap records. Sprays only applied if both model indicates egg laying risk and pheromone trap threshold exceeded.

- Method 3 ‘RimPro’: Use of the RIMpro-Cydia forecasting model in conjunction with an assessment of codling moth damage the previous year to indicate general codling moth risk in the particular orchard.

The ‘Trap’ and the ‘RimPro+trap’ methods performed poorly with unacceptable levels of codling moth damage, which was particularly severe at one site (16.6% and 10.7% fruit

damage at harvest for the two treatments, respectively) and still above an economically acceptable level at another (3.3% and 0.3% damage at harvest for the two treatments, respectively). Less than 0.3% fruit damage can be tolerated economically. The damage appeared to be caused by just below threshold sex pheromone trap catches which did not trigger insecticide sprays. The requirement of ≥ 5 moths per trap in two weeks, not necessarily successive, was not quite met on several occasions. The results indicate that the threshold requirement for two catches ≥ 5 moths is too complex as well as being somewhat illogical as a single catch of moths, no matter how large, would not trigger the need for a spray. It is therefore provisionally proposed that the threshold should be simplified to single catch of ≥ 5 moths per trap in the early half of fruit development (May – July) and that it would be prudent to lower the threshold to ≥ 3 moths per trap per week in the latter part of fruit development (August – September) when the fruit is softer and more susceptible to damage.

These proposed threshold changes will lead to a significant increase in insecticide use for codling moth control. For instance at two of the farms, the number of sprays for codling in the 'Trap' method plots would have increased from 1 to 4 and from 0 to 1, respectively, though the number of sprays at the third site would not have been affected. This would probably have greatly reduced the high levels of codling damage that occurred. Further confirmatory work is needed before the modified thresholds can be recommended.

The RIMpro-cydia method resulted in the greatest number of insecticide applications and the lowest amounts of damage to fruits, though damage at harvest was unacceptably high (3.6% fruit damage) at one site and slightly high (0.7% fruit damage) at another. The model may need adjusting to take into account the higher risk to fruits in August and September as they become softer and riper and more susceptible to damage.

It is recommended that these adjusted thresholds are implemented in the experiment as it continues in 2013-14 at the same site using the same plots.

Financial benefits

Codling moth control programmes typically cost growers >£200/ha/season. Even a low level of fruit damage (< 0.3% fruits damaged) is likely to be economically unacceptable. Improving control and/or reducing insecticide use will be of financial benefit to growers.

Action points for growers

The findings from the first year of this project are preliminary and no grower action points are recommended at this stage.

SCIENCE SECTION

Introduction

Codling moth is the most important pest of apples and also an important pest of pears in the UK. Most insecticide sprays on apple are used against it. Codling moth control programmes typically cost growers >£200/ha/season. Control is usually good, but populations are not being reduced to such low levels that spraying is reduced in subsequent years; growers are on an insecticide treadmill. UK growers generally rely on pheromone traps to decide if and when to spray for codling moth but previous work in HDC project TF 189 suggested that they are of limited benefit and growers may not be making best use of their time and effort in using them.

Experience in the Netherlands indicates that as good or better control of codling moth can be obtained using development and population simulations given by the RIMpro-Cydia model using data from local met stations. The model, which is available to all growers, takes into account when conditions suitable for egg laying occur (dusk temperatures > 15 °C) as well as maturity and longevity of females, rather than activity of males as indicated by sex pheromone trap catches. This work will determine which of the three alternative decision-making methods is best, leading to improvements in control and/or savings in monitoring costs and management time.

Objectives

The general aim of this project is to determine better practical methods for timing sprays of insecticides for the control of codling moth on apple and pear in the UK, thus reducing overwintering populations and achieving better long term control. The specific objective is to determine which of the following methods is best for timing insecticide sprays to get the most cost effective control of codling moth, including in the long term:

1. Standard method of monitoring male moth flight using pheromone traps and spraying after a threshold of > 5 moths for 2 weeks is exceeded;
2. Use of the RIMpro-Cydia forecasting model in conjunction with pheromone trap records. Sprays only applied if both the model indicates egg laying risk and the pheromone trap threshold exceeded;
3. Use of the RIMpro-Cydia forecasting model in conjunction with an assessment of codling moth damage the previous year to indicate general codling moth risk in the particular orchard.

Outline of work

Three large dessert apple orchards on different farms in southern England were each divided into three plots, each plot receiving sprays for codling moth using one of the three different timing methods for three successive years (2012-2014).

The same insecticides were used: Insegar (fenoxycarb); Runner (methoxyfenozide); Coragen (Rynaxypyr®); and Steward (indoxacarb) but it was anticipated that the different methods of spray timing would result in different timings and numbers of sprays being applied. The orchards chosen have a history of significant codling moth pheromone catches and each have a local, high quality, calibrated weather station nearby. Adult codling moth populations in each plot are monitored with a sex pheromone and a pear ester kairomone + sex pheromone combi trap. Larval attack to fruits was assessed in July (first generation) and at harvest. Each year, the forecasts generated and the comparative success of the different methods will be judged in terms of the standard of control achieved, the numbers of larvae overwintering and the numbers and costs of insecticides used.

Materials and methods

Sites

Site 1 (Advisor Paul Bennett, Agrovista): In 'Mealy Meads' Bramley orchard at Amsbury Farm, East Street, Hunton ME15 0Q by kind agreement of Clive Baxter (owner) and with the help of the farm manager Alan Burbridge and spray operator David Gosling (spraying) (Table 1, Figure 1).

Site 2 (Advisor Paul Bennett, Agrovista)*:* In 'Old Orchard' Jonagold at West Pikefish Farm, Laddingford, Maidstone, Kent ME18 6BH by kind agreement of James Smith (owner)
(Table 1, Figure 1).

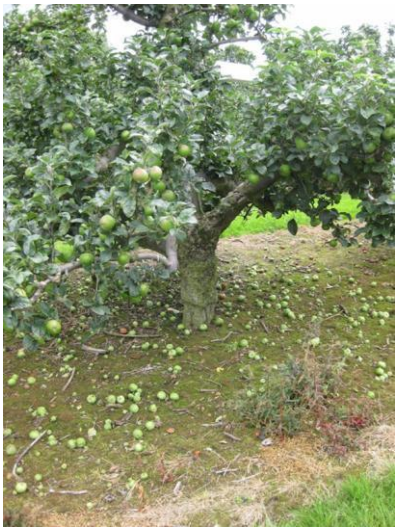
Site 3 (Advisor Tim Biddlecombe, FAST): In 'Deerson' Kanzi orchard at Adrian Scripps Ltd, Wenderton Farm, Wenderton Lane, Wingham, Canterbury, Kent CT3 1EL by kind agreement of the manager Mark Holden and local farm manager Russell Graydon
(Table 1, Figure 1).

Table 1. Details of the orchards where the trials are located

Site 1 - Amsbury Farm	
National grid reference	TQ 738 500
Orchard name	Mealy Meads
Variety	Bramley
Rootstock	MM106
Planting date	>25 years ago
Area	1.0 ha
System	Single row
Row spacing	18’ (= 5.5 m)
Tree spacing in row	9’ (= 2.75 m)
Tree density	661 trees/ha
Tree row height	4
CAF factor at full leaf	1

Site 2 - West Pikefish Farm	
National grid reference	TQ 695 475
Orchard names	Old Orchard
Variety	Jonagold
Rootstock	M9
Planting date	Winter 2008/09
Area	2.65 ha
System	Single row
Row spacing	4 m
Tree spacing in row	1 m
Tree density	2500 trees/ha
Tree row height	
CAF factor at full leaf	

Site 3 - Wenderton Farm	
National grid reference	TR 243 595
Orchard name	Deerson
Variety	Kanzi
Rootstock	M9
Planting date	Spring 2004
Area	13 ha
System	Single row
Row spacing	3.75 m
Tree spacing in row	1.25 m
Tree density	2133 trees/ha
Tree row height	2.5 m
CAF factor at full leaf	1.0



Site 1 Amsbury Farm
MM106 Bramley >25 yr old
1 ha; 666 trees/ha

Site 2. W. Pikefish Fm
M9 Jonagold 3 yr old
2.7 ha; 2500 trees/ha

Site 3. Wenderton Farm
M9 Kanzi 8 yr old
7 ha; 2500 trees/ha

Figure 1. Typical apple trees in the three orchards at the three sites

Treatments

In collaboration with the host grower, each plot received sprays for codling moth using one of the three different scheduling/timing methods (Table 2). 2012 was the first year of the experiment which will continue for two further successive years (2013 and 2014). Insecticides, their preferred order of use and recommended rates are given in Table 3.

Table 2. Treatments

Trt No.	Colour code and name	Method of timing sprays for codling moth
1	Green (G) Trap	Standard method of monitoring male moth flight using delta pheromone traps with sticky inserts and spraying after a threshold of > 5 moths for 2 weeks is exceeded
2	Red (R) RimP+trap	Use of the RIMpro-Cydia forecasting model in conjunction with pheromone trap records. Sprays only applied if both model indicates egg laying risk and pheromone trap threshold exceeded
3	Blue (B) RimP+dam	Use of the RIMpro-Cydia forecasting model in conjunction with an assessment of codling moth damage the previous year to indicate general codling moth risk in the particular orchard

Table 3. Insecticides to be used for codling moth and the preferred order in which they are to be applied

Preferred order	Product	Rate (/ha)	Max dose or no. sprays/ season	Harvest interval (days)	Spray volume (l/ha) Site 1	Site 2	Site 3
1st	Insegar WG	200-600 g	1,200 g	42	500	200	250
2nd, 4th	Coragen	175 ml	2	14	500	200	250
3rd, 5th, 6th	Steward	250 g‡	3	7	500	200	250
7th, 8th	Tracer	150-250 ml	900 ml	7	500	200	250

‡For 3.75 m tall trees. Reduce dose according to height, but not below 170 g/ha

Experimental design and analysis

Each orchard was divided into three large (approximately equal sized) plots. The allocation of plots to treatments is given in Table 4. Diagrams of the layouts of the trials are given in Figures 2-4 for the three sites, respectively.

Table 4. Allocation of treatments to plots

Site 1 (Amsbury - Fig 4)			Site 2 (West Pikefish - Fig 5)			Site 3 (Wenderton - Fig 6)		
Plot no.	Treatment method Col.	Method	Plot no.	Treatment method Col.	Method	Plot no.	Treatment method Col.	Method
101	G	Trap	201	B	RimPro	301	R	RimPro+trap
102	R	RimPro+trap	202	G	Trap	302	B	RimPro
103	B	RimPro	203	R	RimPro+trap	303	G	Trap

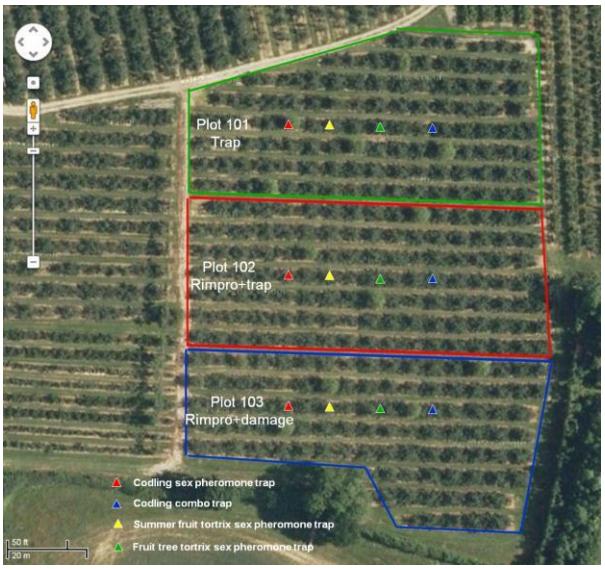


Figure 2. Plots and traps in Mealy Meads orchard at Amsbury Farm

Figure 3. Plots and traps in young Jonagold orchard at West Pikefish Farm

Figure 4. Plots and traps in Deerson orchard at Wenderton Farm

Treatment application

Sprays were applied by the host grower using the growers' normal spray application equipment and spray volume.

Meteorological records

Each of the three farms has a good quality, calibrated met station. Each year in late winter/early spring, the calibration of the local met station used for obtaining met data for the model will be checked.

Assessments

A sex pheromone trap for codling moth, summer fruit tortrix moth and fruit tree tortrix moth and a codling moth combi trap was deployed in the centre of each plot and monitored weekly throughout the season with assistance from the host grower. For locations of the traps see Figures 2-4 for the three sites, respectively.

Larval attack to fruits were assessed in each plot in July (1st generation) and at harvest on samples of at least 1,000 fruits per plot. A fixed number of trees were assessed at each farm, depending on fruit load and tree size. The assessments included fruit on the tree and dropped/fallen fruits.

Each year, the forecasts generated and the comparative success of the different methods will be judged in terms of the standard of control achieved, the numbers of larvae overwintering and the numbers and costs of insecticides used.

Results

Codling moth

Trap treatment

Amsbury Farm

Codling moth sex pheromone trap catches (Figure 5) did not quite exceed the threshold of two catches of 5 or more moths per trap per week, not necessarily successive, in late May-early June (catches were 3, 9 and 3 on 24 May, 31 May and 7 June, respectively). However, a spray of Runner was applied on 6 June (Table 5). No further spray was applied on this plot even after a near threshold miss (catches were 4, 10 and 4 on 26 July, 2 August and 9 August,

respectively).

No damage was recorded on the fruit in July but severe damage (16.55 % of fruits = 22,285 fruits per ha) were damaged at harvest (Table 6). Note that peak catches of 17, 25 and 20 males per trap were captured in the combo traps on 31 May, 5 July and 2 August, respectively (Figure 6). Catches of females in the combo trap were very low, not exceeding 3 in any catch.

West Pikefish Farm

Codling moth sex pheromone trap catches (Figure 5) of 9 and then 12 moths per trap on 28 May and 6 June, respectively, exceeded the threshold of two catches of 5 or more moths per trap per week (not necessarily successive) and a spray of Insegar was applied on 21 June, 15 days later (Table 5). The trap catches stayed low for the rest of the season, not exceeding 2 moths per week.

Very slight fruit damage (0.01% of fruits = 50 fruits per ha) was observed in July and 0.68% of fruits (= 3000 fruits/ha) were damaged at harvest (Table 6). Combo trap peaks of 11, 14 and 17 codling moths per trap (the moths were not sexed at this site) occurred on 6 June, 18 June and 9 July, respectively (Figure 6).

Wenderton Farm

Codling moth sex pheromone trap catches were low and did not exceed the threshold of two catches of 5 or more moths per trap per week (not necessarily successive), although there was a near miss of 4 then 8 on 18 and 25 June, respectively (Figure 5). No insecticide sprays were applied (Table 5).

In July 0.38% (= 853 fruit per ha) were damaged by codling moth and at harvest 3.33% of fruits (= 7,950 fruits per ha) (Table 6). Combo trap catches of male codling moth reached a peak of 33 on 25 June, and a high peak of 19 females was recoded on 28 May with 8 on 25 June (same date as the male peak).

RimPro treatment

Amsbury Farm

RimPro–cydia model predictions using data from the met station at nearby Westerhill Farm showed high levels of egg laying, well above 100 on the risk scale for four successive days starting on 27 June, for four successive days starting 3 July, on 17, 18 and 20 July and was just above 100 for five successive days on 24 - 28 July. Larval hatch was predicted to occur more or less continuously between 8 July and 19 August (Figure 7). Sprays of Runner, Insegar and Coragen were applied on 6 June, 27 June and 3 August, respectively (Table 5).

No codling moth damage was recorded in July but 3.62% of fruits (= 10,245 fruits per ha) were found to be damaged at harvest (Table 6). Catches of males in the combo traps reached peaks of 16 and 10 on 31 May and 2 August, respectively. Catches of females in the combo traps were very low (≤2) throughout.

West Pikefish Farm

RimPro–cydia model predictions using data from the farm met station showed high levels of egg laying, well above 100 on the risk scale on 25 June then for four successive days starting on 27 June, for four successive days starting 3 July and on 17 July and was just above 100 for five successive days on 24 - 28 July, except 27 July. Larval hatch was predicted to occur more or less continuously between 7 July and 19 August (Figure 7). Sprays of Insegar, Coragen and Steward were applied on 28 June, 12 July and 3 August, respectively (Table 5).

No codling moth damage was recorded in July and 0.01% of fruits (= 500 fruits per ha) were found to be damaged at harvest (Table 6). Catches of codling moths in the combo traps had peaks of 23 and 10 on 6 June and 18 June, respectively (Figure 6). Separate records of catches of females were not taken at this site.

Wenderton Farm

The RimPro-cydia model predictions using data from the Wenderton Farm met station showed levels of egg laying above 100 on 8 June, 25 – 30 June, 3 – 11 July and 17 and 18 July. Larval hatch was predicted to occur more or less continuously between 28 June and 12 August (Figure 7). Sprays of Insegar and Coragen were applied on 19 June and 4 July, respectively (Table 5).

No codling moth damage was recorded in July but 0.69% of fruits (= 1,551 fruits per ha) were found to be damaged at harvest (Table 6). High catches of 53 and 46 males were recorded in the combo traps on 25 June and 2 July, respectively, with concurrent catches of 19 and 6 females, respectively (Figure 6).

RimPro+trap treatment

Amsbury Farm

The codling moth trap threshold of 5 or more moths per trap per week for two weeks not necessarily successive was not exceeded in this plot, although the records of 4 and 9 moths on 2 and 9 August, respectively, was a near miss (Figure 5). RimPro–cydia model predictions using data from the met station at nearby Westerhill Farm showed high levels of egg laying, well above 100 on the risk scale, for four successive days starting on 27 June, for four successive days starting 3 July, on 17, 18 and 20 July and was just above 100 for five successive days

on 24 - 28 July. Larval hatch was predicted to occur more or less continuously between 8 July and 19 August (Figure 7). Though a spray of Runner was applied on 6 June, this was not required by the treatment regimen as at no time did both the trap and the RimPro model predictions exceed threshold.

In July, 0.34% of fruits (=768 fruits/ha) were damaged by codling moth and at harvest 10.7% of fruits (= 27,597 fruits/ha) were damaged (Table 6). Catches of male codling moth in the combo traps were low, the highest catch being 12 on 31 May (Figure 6). Only 1 female was captured, on 14 June.

West Pikefish Farm

The codling moth trap threshold of 5 or more moths per trap per week for two weeks, not necessarily successive, was not exceeded in this plot though the records recorded 4 and 6 moths on 28 May and 6 June, respectively (Figure 5). RimPro–cydia model predictions using data from the farm met station at showed high levels of egg laying well above 100 on the risk scale on 25 June then for four successive days starting on 27 June, for four successive days starting 3 July and on 17 July and was just above 100 for five successive days on 24 - 28 July, except 27 July. Larval hatch was predicted to occur more or less continuously between 7 July and 19 August (Figure 7). At no time did both the trap and the RimPro model predictions exceed threshold and no insecticide sprays were applied.

No codling moth damage was recorded in July and 0.48% (= 1,750 fruits per ha) were recorded at harvest (Table 6). Catches of moths in the combo traps were low, the highest catch being 11 on 6 June (Figure 6).

Wenderton Farm

Codling moth sex pheromone trap catches of 7, 9 and 8 moths were recorded on 28 May and 18 and 25 June, respectively. The threshold of 5 or more moths per trap per week for two weeks, not necessarily successive, was exceeded on 25 June (Figure 5). Model predictions of significant egg-laying were given for 6 successive days from 25 June to 30 June and a spray of Insegar was applied on 27 June (Table 5).

In July and at harvest, 0.34% (= 768 fruits/ha) and 0.27% (= 582 fruits/ha) were found to be damaged by codling moth (Table 6). Combo trap peaks of 35 males and 8 females were recorded on 25 June (Figure 6).

Tortrix moths

Sex pheromone trap catches of fruit tree tortrix were greatest at West Pikefish Farm where they exceeded the threshold of 30 moths per trap on 2 July in the ‘Trap’ plot and 28 June in the ‘RimPro+Trap’ plot (Figure 9). Sex pheromone trap catches of summer fruit tortrix moth were

greatest at Wenderton Farm, but remained well below the threshold of 30 moths per trap per week throughout, peak first generation catches of 10 or 11 moths being recoded on 25 June in all three plots and with peak 2nd generation catches on 20 August (Figure 9).

No fruit damage was recorded in July (Table 7). No sprays targeted specifically at tortrix moths were

applied. At harvest low levels of damage (<0.21% fruits) were recorded in all plots at Amsbury Farm, no damage at West Pikefish Farm, and 0.89% (= 2,133 fruits/ha) and 0.26% (= 582 fruits/ha) damage in the 'Trap' and the 'RimPro' plots at Wenderton Farm (Table 7).

Table 5. Dates of application of insecticide sprays according to treatment

Site	Trap		RimPro				RimPro+trap	
	Runner	Insegar	Runner	Insegar	Coragen	Steward	Runner	Insegar
Amsbury	6 Jun		6 Jun	27 Jun	3 Aug		6 Jun	
Pikefish		21 Jun		28 Jun	12 Jul	3 Aug		
Wenderton				19 Jun	4 Jul			27 Jun

Table 6. Number and percentage fruits damaged by codling moth in July and at harvest

	Trap		Rimpro		Rimpro + trap	
Site	**no:/ha**	**%**	**no:/ha**	**%**	**no:/ha**	**%**
			July			
Amsbury	0	0.00	0	0.00	0	0.00
Pikefish	50	0.01	0	0.00	0	0.00
Wenderton	853	0.38	0	0.00	768	0.34
			Harvest			
Amsbury	22,285	16.55	10,246	3.62	27,597	10.73
Pikefish	3,000	0.68	500	0.10	1,750	0.48
Wenderton	7,950	3.33	1,551	0.69	582	0.27

Table 7. Number and percentage fruits damaged by tortrix moth in July and at harvest

Site	Trap		Rimpro		Rimpro + trap	
	no:/ha	%	no:/ha	%	no:/ha	%
			July			
Amsbury	0	0.00	0	0.00	0	0.00
Pikefish	0	0.00	0	0.00	0	0.00
Wenderton	0	0.00	0	0.00	0	0.00
			Harvest			
Amsbury	283	0.21	496	0.17	331	0.13
Pikefish	0	0.00		0.00	0	0.00
Wenderton	2,133	0.89	582	0.26	0	0.00

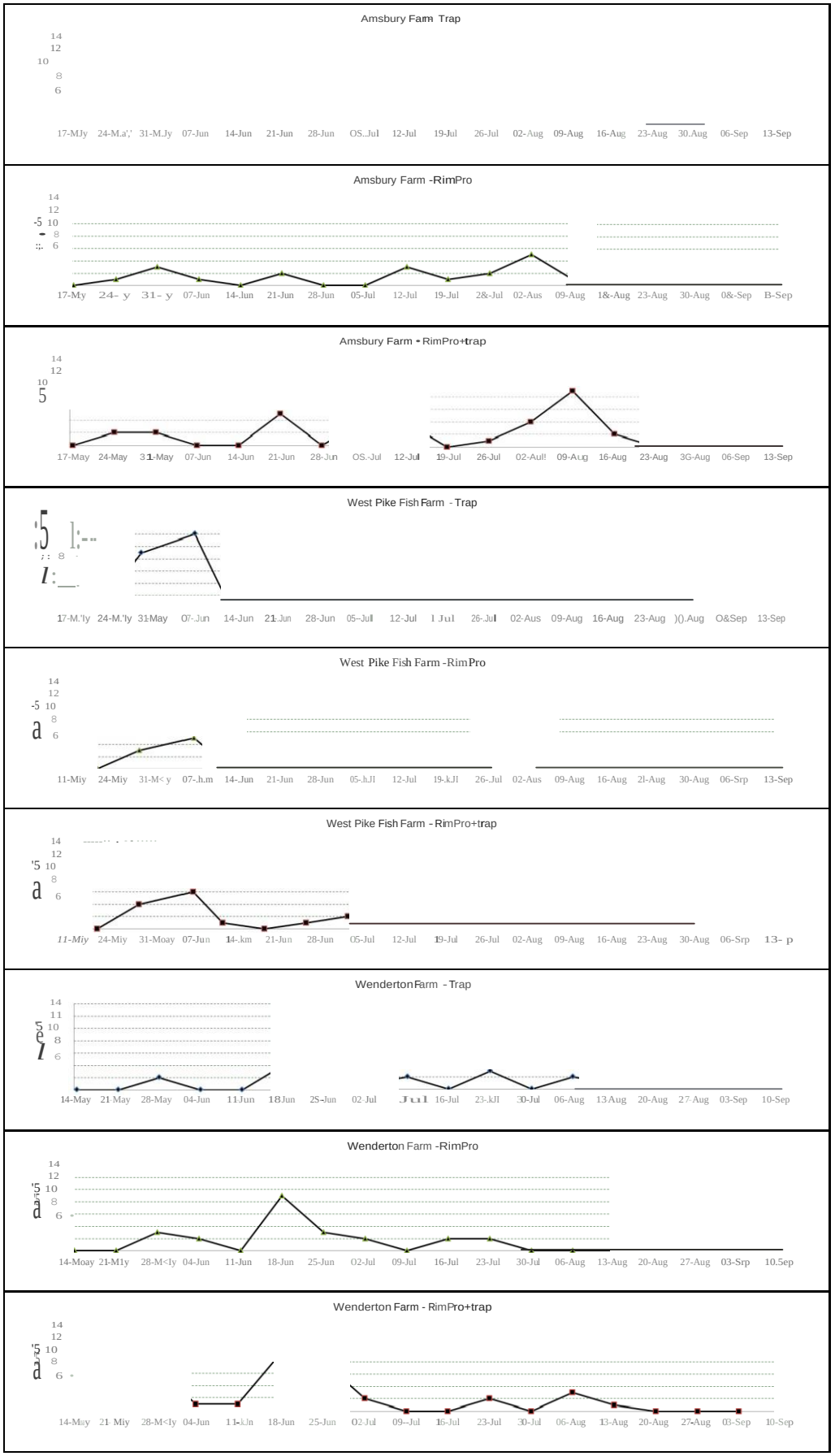


Figure 5. Codling moth sex pheromone trap catches 2012

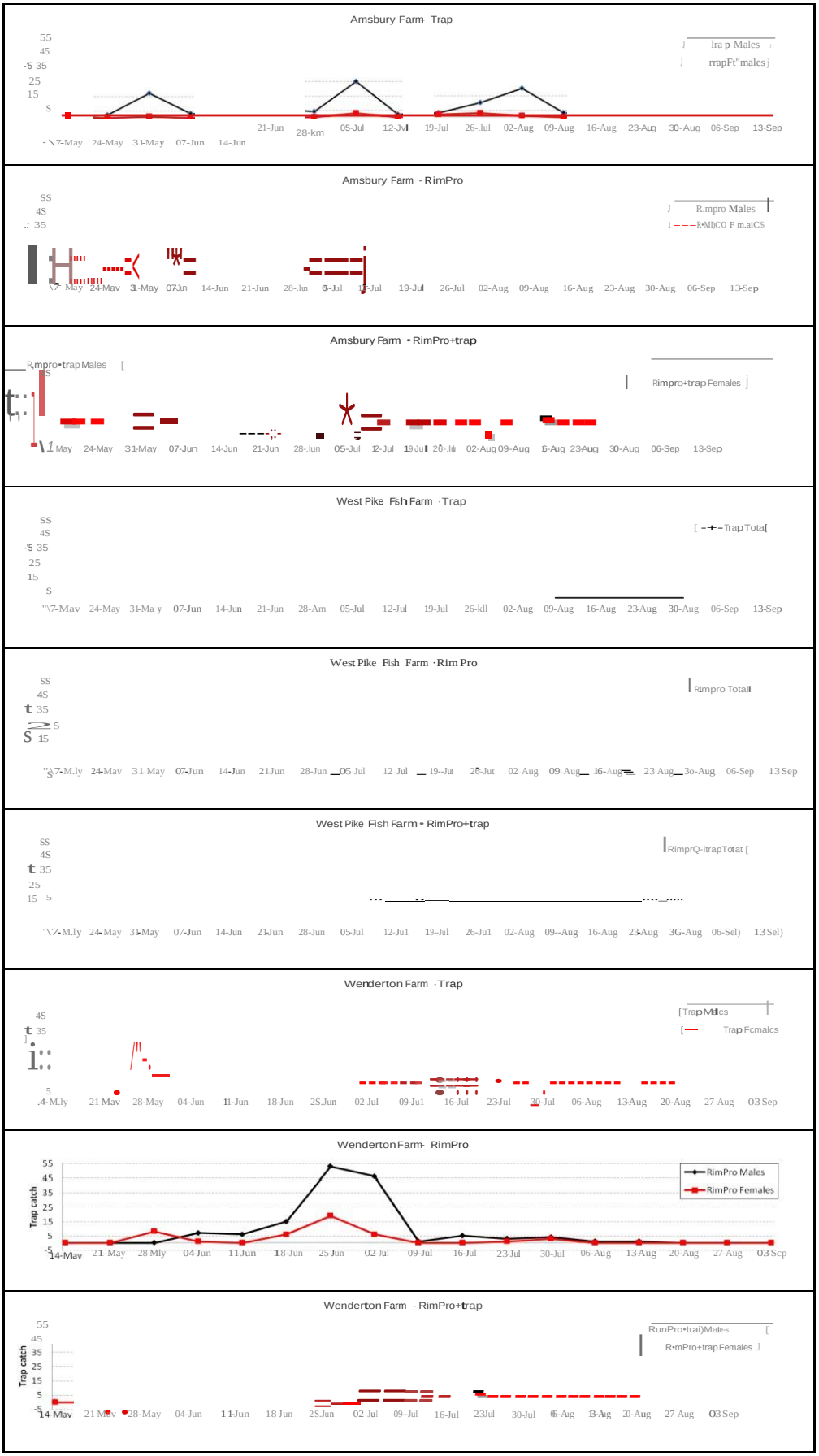
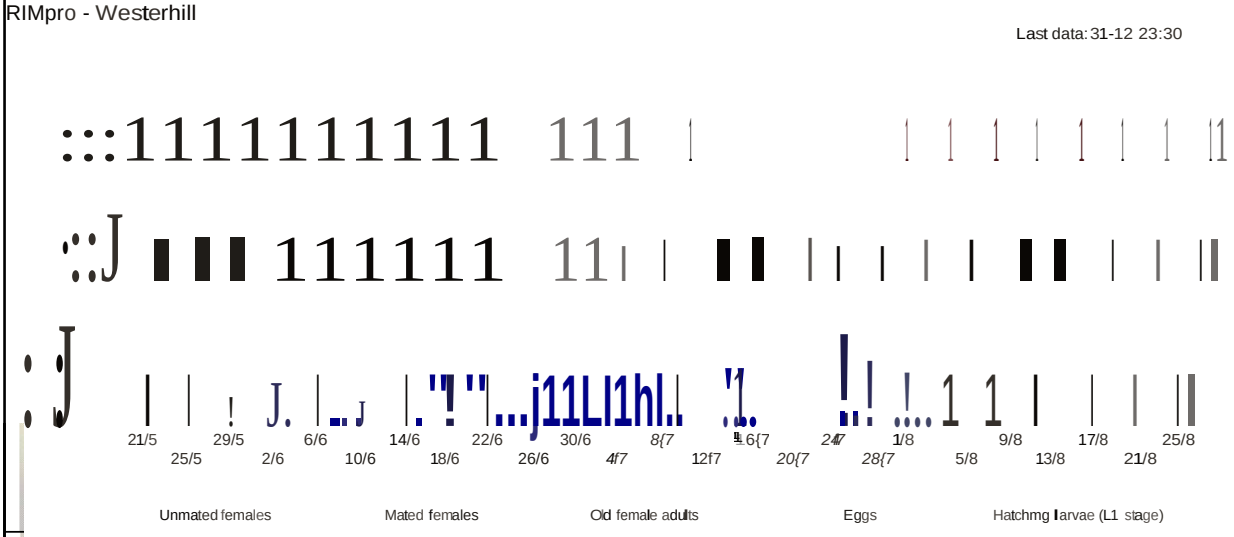
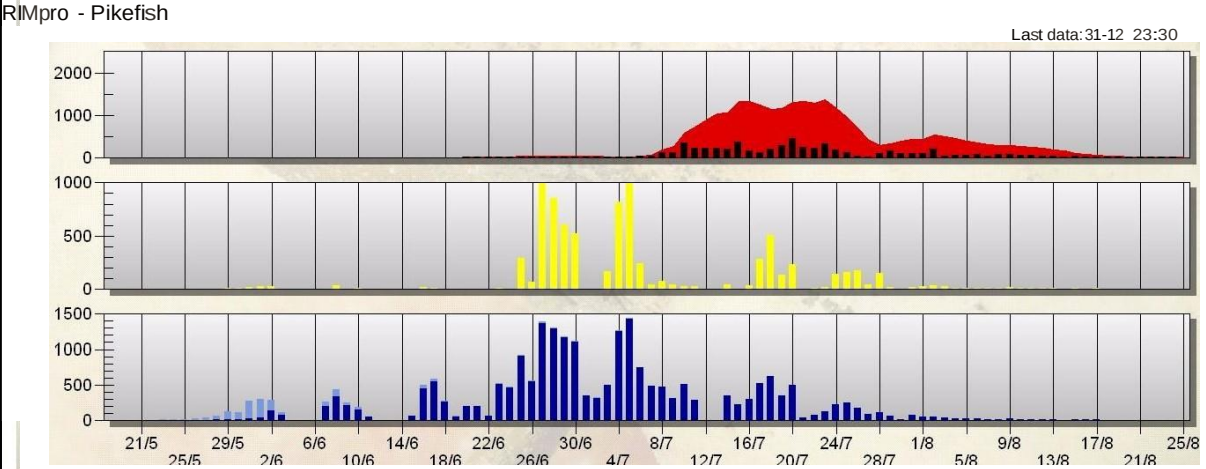


Figure 6. Codling moth combo trap catches 2012

Cydia pomonella
RIMpro - Westerhill



Cydia pomonella
RIMpro - Pikefish



Cydia pomonella
RIMpro - Wenderton

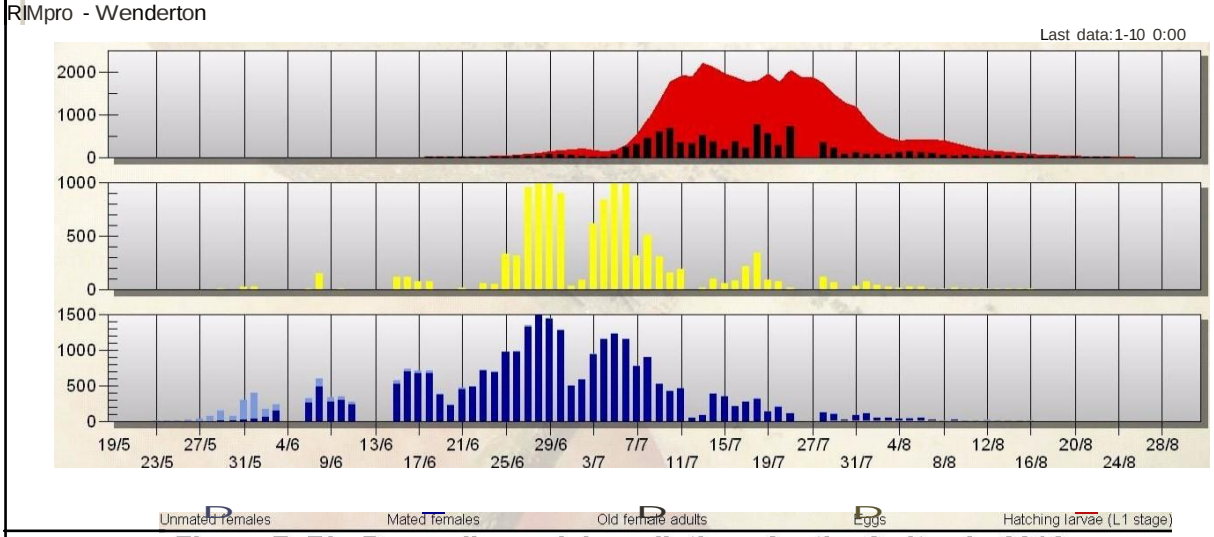


Figure 7. RimPro-cydia model predictions for the 3 sites in 2012.

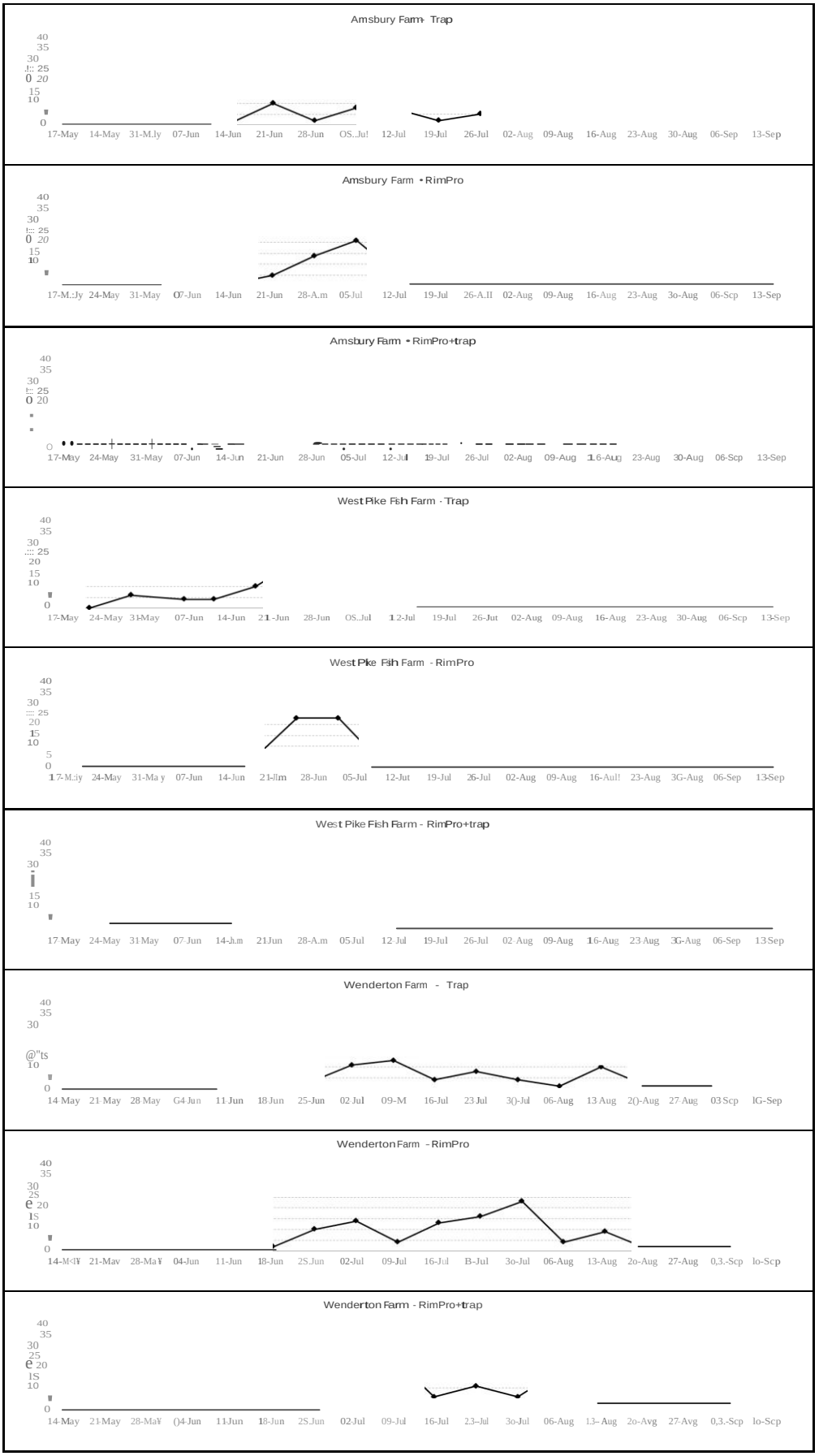


Figure 8. Fruit tree tortrix moth sex pheromone trap catches 2012

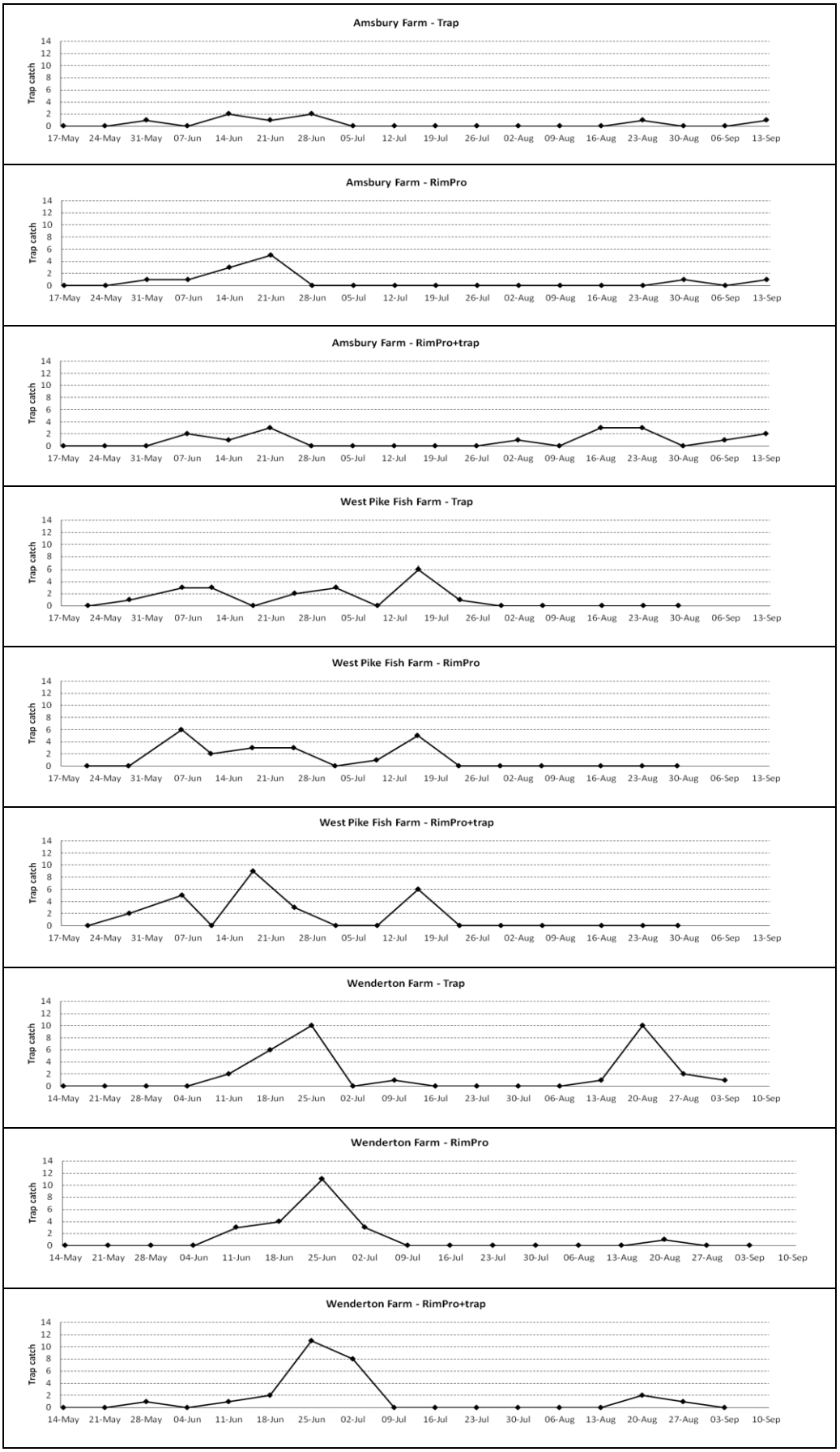


Figure 9. Summer fruit tortrix moth sex pheromone trap catches 2012

Discussion and conclusions

The 'Trap' and the 'RimPro+trap' treatments performed poorly, with unacceptable levels of codling moth damage, which was particularly severe at Amsbury Farm and still well above an economically acceptable level at Wenderton Farm. With insecticide sprays costing typically £60 per ha (not including application costs, which are negligible if fungicide sprays are being applied anyway) and with fruit usually worth >£20,000 per ha, less than 0.3% fruit damage can be tolerated economically. The damage appeared to be caused by just below threshold sex pheromone trap catches, which did not trigger insecticide sprays. The threshold of ≥5 moths per trap in two weeks, not necessarily successive, was not quite met on several occasions, notably at Amsbury Farm in May - June and July – August, and at Wenderton Farm in May - June.

The requirement for two catches of ≥5 moths is too complex and insensitive. A single catch of moths, no matter how large, will not trigger the need for a spray. For example, successive catches of 4, 100 and then 4 would not exceed the threshold if strictly interpreted. The threshold was set as a result of extensive field trials by ADAS in the 1960s and 1970s at a time when highly effective broad spectrum insecticides (carbaryl, azimphos-methyl) were widely used for codling moth control and when yields were lower and fruit less valuable.

It is therefore provisionally proposed that the threshold should be simplified to a single catch of ≥5 moths per trap for the first generation (May – July). The high levels of damage that occurred at Amsbury Farm in August indicate that the threshold should be further lowered in August and September when the fruit is particularly susceptible to damage. At this time it would be prudent to lower the threshold to ≥3 moths per trap per week.

These threshold changes will lead to a significant increase in insecticide use for codling moth control and further confirmatory work is needed before they can be recommended. For instance at Amsbury and Wenderton Farms, the number of sprays for codling in the Trap treated plots would have increased from one to four and from none to one, respectively (Table 8). This would probably have greatly reduced the high levels of codling damage that occurred.

Table 8. Catches of codling moth in sex pheromone trap in the 'Trap' plots had the modified thresholds been applied

Period	Amsbury			Pikefish			Wenderton		
	Date	Catch		Date	Catch		Date	Catch	
May-July	31 May	9	Y	28 May	9	Y	25 June	8	Y
Threshold 5	21 June	8	Y	6 June	12	N			
	12 July	7	Y						
August-September	2 August	10	Y						
Threshold 3	9 August	3	N						
Total sprays			4			1			1
Total actually applied			1			1			0

The combo traps mainly caught males, generally in larger numbers than the sex pheromone traps. Catches of females were small and erratic. Whilst they have a place for monitoring the success of sex pheromone mating disruption treatments, no real other advantages over the sex pheromone traps were apparent for timing pesticide sprays. If they were to be used, treatment thresholds would need to be re-set for them.

The RIMpro-cydia treatment performed best, although damage at harvest was unacceptably high (3.6% fruit damage) at Amsbury Farm and slightly high (0.7% fruit damage) at Wenderton. It may be that the model does not take into account the higher risk in August and September as fruits become softer and riper and more susceptible to damage.

It is recommended that these adjusted thresholds are implemented in the experiment as it continues in 2013-14 at the same site using the same plots.

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