Project title	Apples and Pears: The use of biological control and plant health promoters to effect control of fireblight (*Erwinia amylovora*).
Project number:	TF 183
Project leader:	Gary Saunders, Farm Advisory Services Team Ltd.
Report:	Annual report, March 2009
Previous report	None
Key staff:	Gary Saunders
Location of project:	Ham Green Farm, Upchurch, Sittingbourne, Kent
Project coordinator:	[Name, Organisation, Address]
Date project commenced:	01/04/08
Date project completed (or expected completion date):	31/03/11
Key words:	*Bacillus pumilis*, *Bacillus subtilis*, *Erwinia amylovora*, fireblight, Harpin, Pre-tect, Regalis, Sentry P, Sentry S.

The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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Grower Summary

Headline

- Due to the low incidence of fireblight throughout the trials it was not possible to draw any definite conclusions relating to the effectiveness of the treatments of Pre-tect, Regalis + Cuprokylt FL, Sentry P and Sentry S (Serenade equivalent) for fireblight control.

Background and expected deliverables

Fireblight, caused by the bacterium *Erwinia amylovora*, is a widespread destructive bacterial disease of pome fruit trees and other related plants and is seen with increasing frequency. Typical symptoms include wilting and death of flower clusters and withering and death of young shoots causing a loss of fruiting wood and potentially tree death. Control in the UK is limited to cutting out diseased material and copper sprays which can lead to russeting of the fruit surface. In fact Defra states that "There are no effective chemical measures available in the UK to control Fireblight" (PB 10843). In the USA antibiotics are used but they are not allowed in the UK currently.

A suitable method of control would benefit the industry in two ways:

1. Reduce labour costs by eliminating the need for cutting out infected shoots;
2. Increase cropping potential as potential fruit bearing wood would not be removed.

Summary of the project and main conclusions

The introduction of certain biological control agents and plant health promoters offers the opportunity for potential fireblight control. This project will determine the effectiveness of the products Pre-tect (active ingredient harpin), Regalis + copper, Sentry P (active ingredient *Bacillus pumilis*) and Sentry S (active ingredient *Bacillus subtilis*) against fireblight.

Egremont Russet apple and Concorde pear are known to be particularly susceptible to the disease and were therefore chosen for the first year of this project.

Treatments of Pre-tect (1kg in 500L/ha), Regalis (0.5kg in 500L/ha) + copper (Cuprokylt FL 2.5L in 500L/ha), Sentry P (15L in 1000L/ha), Sentry S (Serenade equivalent) (10L in 1000L/ha) and a control were applied as a randomised block experiment with five blocks of five trees per treatment. Bacillus and harpin treatment applications began prior to bud burst and consisted of fifteen weekly applications. Copper was applied pre bud-burst and Regalis was applied mid-April and mid-May prior to two predicted infection periods.

Assessments of Fireblight were made monthly throughout the growing season from March to August. Both orchards were on a sandy loam soil with individually staked trees laid out as single row beds. All branches showing symptoms of fireblight prior to the beginning of the treatments and at the end of the assessment period were pruned out.

Levels of fireblight were too low in this first year of the trial for the Concorde treatment plots to determine if any of the treatments were effective. In the case of Egremont Russet as there was no incidence of fireblight recorded in or near to the plots, the decision was made to use a nearby Gala orchard for the second year of the trial as it had a high incidence of fireblight throughout during 2008.

Due to the low incidence of fireblight throughout the experiment it was not possible to draw any definite conclusions relating to the effectiveness of the treatments.

Action points for growers

- Inspect vulnerable orchards routinely for fireblight symptoms during winter pruning, soon after bud break, during mid June, from late July to early August and soon after leaf fall. Inspect young trees more frequently.
- Make additional inspections after frost, following storms and when fireblight warnings are issued.
- Slice off bark to determine the extent of infection and then cut out diseased wood at least 30cms below the stained tissue on smaller wood (< 2cm diameter) and at least 50 cm below on larger wood.
- Disinfect tools between cuts and burn diseased wood.

Science Section

Introduction

Fireblight, caused by the bacterium *Erwinia amylovora*, is a widespread destructive bacterial disease of pome fruit trees and other related plants and is seen with increasing frequency. Typical symptoms include wilting and death of flower clusters and withering and death of young shoots causing a loss of fruiting wood and potentially tree death. Control in the UK is limited to cutting out diseased material and copper sprays which can lead to russeting of the fruit surface. In fact Defra states that "There are no effective chemical measures available in the UK to control Fireblight" (PB 10843). In the USA antibiotics are used but they are not allowed in the UK currently.

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3. Reduce labour costs by eliminating the need for cutting out infected shoots;
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The introduction of certain biological control agents and plant health promoters offer the opportunity for potential Fireblight control. This project will determine the effectiveness of the products: Pre-tect (active ingredient harpin), Regalis + copper, Sentry P (active ingredient *Bacillus pumilis*) and Sentry S (active ingredient *Bacillus subtilis*) against fireblight.

Egremont Russet apple and Concorde pear are known to be particularly susceptible to the disease and were therefore chosen for the first year of this project. Trees were sprayed weekly for fifteen weeks from just prior to bud burst for the *Bacillus* and harpin products. Copper was applied pre bud-burst and Regalis was applied prior to predicted infection periods. Assessments were made of the incidence of fireblight.

Materials and methods

Two varieties known to be susceptible to fireblight in orchards where the disease was known to be present were evaluated in the first year of the trial, one apple – Egremont Russet and one pear – Concorde.

Treatments of Pre-tect (1kg in 500L/ha), Regalis (0.5kg in 500L/ha) + copper (Cuprokylt FL 2.5L in 500L/ha), Sentry P (15L in 1000L/ha), Sentry S (Serenade equivalent) (10L in 1000L/ha) and a control were applied as a randomised block experiment with five blocks of five trees per treatment. Bacillus and harpin treatment applications began prior to bud burst and consisted of fifteen weekly applications beginning 06/03/08 and ending 12/06/08. Copper was applied pre bud-burst (06/03/08) and Regalis was applied (22/04/08 & 13/05/08) prior to two predicted infection periods. Assessments of fireblight were made monthly throughout the growing season from March to August. Both orchards were on a sandy loam soil with trees individually staked, tree spacing was 2 x 3.75m for Concorde and 1.5 x 3.75m for Egremont Russet. All branches showing symptoms of fireblight prior to the beginning of the treatments and at the end of the assessment period were pruned out.

Results

The incidence of occurrence of fireblight development throughout the season for Concorde and Egremont Russet are shown in Tables 1 and 2 below.

	06/03	15/04	13/05	12/06	01/07	06/08
Control	0	0	0	1	2	2
Pre-tect	0	0	1	2	2	2
Copper+ Regalis	0	0	0	2	3	3
Sentry P	0	0	0	0	0	0
Sentry S	0	0	0	2	2	2

Table 1: Incidence of fireblight in Concorde (total infected branches on 25 trees)

Symptoms of fireblight did not develop until May and no further infected shoots appeared after the end of July in the assessed plots for Concorde. Levels in these assessed plots were much lower than in other parts of the orchard with a gradient of occurrence where the highest incidence of fireblight occurred away from the assessed plots. From historical observation prior to this trial the occurrence of fireblight is moving rapidly through the orchard towards the treatment plots.

	06/ 03	15/ 04	13/ 05	12/ 06	01/ 07	06/ 08
Control	0	0	0	0	0	0
Pre- tect	0	0	0	0	0	0
Copper+ Regalis	0	0	0	0	0	0
Sentry P	0	0	0	0	0	0
Sentry S	0	0	0	0	0	0

Table 2: Incidence of fireblight in Egremont Russet

No incidence of fireblight was observed in the Egremont Russet trees (Table 2) .

Discussion

Levels of fireblight were too low in the Concorde treatment plots to determine if any of the treatments were effective, however as the spread of fireblight throughout the orchard was rapidly increasing towards the treated plots the decision was made to continue with these plot locations for the remainder of the trial period.

As there was no incidence of fireblight recorded in the Egremont Russet plots, or near to the plots, the decision was made to use a nearby Gala orchard that had a high incidence of fireblight throughout it during 2008, for the second year of the trial.

Conclusions

Due to the low incidence of fireblight throughout the experiment it was not possible to draw any definite conclusions relating to the effectiveness of the treatments.

