Grower Summary

TF 217

Improving the management of bacterial canker in stone fruits

Final 2015

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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 AHDB Horticulture office (hort.info.@ahdb.org.uk), quoting your AHDB Horticulture number, alternatively contact AHDB Horticulture at the address below.

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Project Number:	TF217
Project Title:	**Improving the management of bacterial canker in stone fruits**
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Headlines

- Copper oxychloride is still the most effective product to use against bacterial canker caused by *Pseudomonas syringae* pv. *morsprunorum*.
- Copper may not be so effective against bacterial canker caused by *Pseudomonas syringae* pv. *syringae,* as some strains were found to be copper resistant.
- There was no evidence for a benefit from any of the 'resistance inducers' or 'elicitors' or disinfectants applied as foliar sprays.

Background and expected deliverables

Bacterial canker of *Prunus* spp. has been an on-going problem for stone fruit growers for many years. It may be caused by two distinct pathovars of *Pseudomonas syringae*: pv. *morsprunorum* (*Psm*) and pv. *syringae* (*Pss*). *Psm* is host specific to *Prunus* spp., whereas pv. *syringae* potentially has a much wider host range, with the potential for cross infection between a number of different species and genera.

Bacterial canker can kill trees, but as well as cankers, these pathogens may also cause leaf spots/shot-holes, shoot die-back, flower blights, fruit spotting and rots, although the stem canker phase is probably the most economically important.

It is important to note that stem cankers result from infections which have been initiated in the previous year, and may not always be obvious in the first year after infection. Therefore cankers are sometimes not seen until 18 months after the initial infection has taken place.

For many years (based on work done at East Malling Research in the 1960's and 70's), *Psm* was considered to be the primary cause of the disease in the UK.

During a MAFF-funded survey of 'Farm Woodland' cherries in 2001-02, led by the current project leader, it became clear that both pathogens were causing canker in England (Vicente *et al.* 2004).

An HDC-funded project on bacterial canker during nursery production (HNS 179) (Roberts 2013) has recently been completed.

As part of HNS 179 we reviewed (in 2012) (Roberts 2013) the global research literature on the control of bacterial canker and a factsheet is in production. We do not expect that the global situation has changed much since that time, therefore it was considered to be more cost-effective to re-target this information, changing the emphasis to fruit rather than nursery production.

Also as part of HNS 179 (Roberts 2013) we conducted three years of spray trials on trees during nursery production. The overall conclusion was that copper oxychloride was the most effective spray treatment. However, partly due to limitations in the in the scope of the project, and partly due to HDC policy, so-called 'grey-products' (i.e. products that are not marketed as plant protection products but may nevertheless provide some benefit) were not examined. HDC policy has now changed as a result of a change in guidance form CRD.

There have been recent reports from the USA that copper sprays have become ineffective due to the development of resistant pathogen strains (Scheck, Pscheidt and Moore 1996; Pscheidt 2013). There is no recent information (two strains were tested in HNS 91 in 2000) (Roberts and Akram 2002) on whether or not UK strains of the bacterial canker pathogens are resistant. As a result of the work in HNS 179 we have a collection of pathogen strains from trees which have been sprayed six times a year with copper for three years, plus strains from untreated trees. These strains therefore present an ideal opportunity to examine the potential for resistance to develop in the UK.

The main objectives of the project were to:

1. Perform preliminary evaluations of potential spray products.
2. Determine if there is any evidence of copper resistance in recent isolates of the pathogens.
3. Produce best-practice guidelines for the management of bacterial canker in plums and cherries during fruit production.

Summary of the project and main conclusions

Spray trials

Spray trials were carried out on plums (cv. Victoria) inoculated with *Psm.* Nine treatments plus an untreated control were examined. A number of potential 'resistance inducers' or 'elicitors' and other products (see Table 1) were included. The trees used were potted maidens growing in a polytunnel. Spraying and inoculation was done at two times of the year: in late spring to examine effects on leaf populations and leaf symptoms and in the autumn to examine the development of the canker phase resulting from leaf scar infections. In both cases all products (see Table 1) except the disinfectants were sprayed onto the trees one week before inoculation. The disinfectants were applied either the day before or day after inoculation.

Table 1. Spray treatments, rates, and timings

Code	Product (Active ingredient)	Rate*	Timing (relative to day of inoculation)	Basis for inclusion (approval status)
Un	Untreated control	-	-	Negative control
Cu	Cuprokylt (copper oxychloride) + Activator 90 wetter	3 kg/ha, 0.25 mL/L Activator	Spray 7 d before	Standard treatment (full approval)
Bi	Bion (acibenzolar-s-methyl)	60 g/ha	Spray 7 d before	Resistance inducer, positive reports vs. citrus canker (not approved)
Hx	Hexanoic acid	1 mM	Spray 7 d before	Resistance inducer, positive reports vs. citrus canker (not approved)
Ph	Phorce (phoshite)	2 L/ha	Spray 7 d before	Resistance inducer (foliar fertiliser, approval not required)
Fr	Frostect (Harpin protein)	200 g/ha	Spray 7 d before	Resistance inducer, indication of activity vs. fireblight (not a PPP, approval not required)
Se	Sentry R (plant extract from *Reynoutria* spp.) with Yuccah wetter	1% plus 0.04% wetter	Spray 7 d before	Resistance inducer (not a PPP, approval not required)
Fe	Fenomenal (fosetyl-aluminium and fenamidione)	2.25 kg/ha	Spray 7 d before	Contains fosetyl-aluminium, which had indications of benefit v. canker in HNS 179 (not approved)
J5	Jet 5 (peroxyacetic acid)	0.8%	Spray 1 d before/after	Disinfectant (not approved)
Xi	XzioX (chlorine dioxide)	50 ppm	Spray 1 d before/after	Disinfectant (not approved, but may be used to disinfect water)

*All products were applied as a high volume spray, equivalent to 1000 L/ha

In the Spring treatment, inoculation was done by spraying the leaves with a suspension of *Psm*. Leaves were than sampled six days later and 'washed' to estimate pathogen populations, and leaf symptoms recorded two to three weeks later. The leaf inoculations

successfully resulted in the development of typical disease symptoms. Cuprokylt (copper oxychloride) was the only product that gave any reduction in pathogen populations

compared to the untreated control, and although there was also a reduction in the percentage of infected leaves, this was not statistically significant. The autumn treatments were assessed the following spring. However, it appears that the inoculations failed as there was no disease development even in the untreated controls (we expected to at least see death/failure of some of the buds). Therefore no conclusions could be drawn about the effects of the treatments on leaf scar infections.

None of the treatments gave any indications of phytotoxicity.

Copper resistance

To check for copper resistance, twenty-two isolates of the bacterial canker pathogens, obtained from spray trials done as part of the previous HDC-funded project (HNS 179), were tested for copper resistance. Isolates came from both plums and cherries; some were from trees that had received up to 18 copper sprays over 3 years.

None of the eleven isolates of *Psm* showed any signs of copper resistance. However, most (seven out of eleven) of the *Pss* isolates showed some level of copper resistance. Thus, at least some of apparently inconsistent levels of control with copper sprays could be a result of the presence of copper resistant strains of *Pss,* particularly on cherry where *Pss* may be more prevalent. It should be noted that these 'resistant' strains are not completely resistant to copper and growth was still inhibited at higher copper concentrations, but it does highlight the need to understand which pathogen is responsible for causing disease in any particular orchard.

Table 2. Summary of copper sensitivity tests on 22 strains of *Pseudomonas syringae* isolated from copper-treated and un-treated plum and cherry trees.

Pathovar	Source	No. resistant	No. tested
Pseudomonas syringae pv. *morsprunorum*	Plum	0	7
	Cherry	0	4
Pseudomonas syringae pv. *syringae*	Plum	3	5
	Cherry	4	6

Financial benefits

There are no particular financial benefits arising directly from this project, but growers may be able to make savings by not applying sprays that may have little direct benefit.

The value of UK plum production is potentially around £12 million pa (Defra statistics 2011

value). The values for cherry production are no longer reported separately but are likely to be over £2 million (based on the most recent, 2007 figure). Bacterial canker has been a continuing problem for plum and cherry growers for many years. There are no definitive estimates for losses caused by bacterial canker and the impact of the disease on individual growers is likely to vary considerably depending on factors such as orchard age, intensity of production, etc. However, even a conservative estimate of average losses of ca. 5% p.a. would mean reducing losses from bacterial canker could be worth in excess of £0.5 million p.a.

Action points for growers

- Copper sprays in the form of Cuprokylt + wetter (Activator 90) are still the most effective chemical control option available for bacterial canker caused by Psm.
- Copper sprays may be less effective against Pss due to the presence of resistance strains. It is therefore important to send samples for accurate diagnosis to understand the 'enemy'.
- In a previous project the highest levels of Psm were seen in the spring and summer, so the current label recommendations for three sprays in late summer may be starting too late to have a significant impact and growers may wish to consider earlier spray applications.
- New orchards should ideally be planted with pathogen-free trees.
- Growers should not rely on EU plant passports as an indication of health status and freedom from bacterial canker pathogens. Trees and their mother-plants should be inspected for disease symptoms when in leaf.
- Indexing of mother plants and trees for planting for pathogen should also be considered.