Grower Summary

HNS 179

Management of bacterial canker in plums and cherries during nursery production

Final 2013

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

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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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Headlines

- Levels of the bacterial canker pathogens *Pseudomonas syringae* pv. *morsprunorum* (*Psm*) and *P. s.* pv. *syringae* (*Pss*) were reduced by sprays of Cuprokylt (copper oxychloride) + wetter (Activator 90).
- There was no evidence for improved control by mixing Cuprokylt (copper oxychloride) with Dithane NT (mancozeb), or using a sticker (Nu-Film P) rather than a wetter.
- There was no evidence of a consistent benefit from the biological control agent Serenade ASO (*Bacillus subtilis* strain QST 713) either alone or alternating with Cuprokylt (copper oxychloride).
- The overall levels of the pathogens varied from year to year and with time of year, levels of both *Psm* and *Pss*, but especially *Psm* were greater on plum than on cherry.
- A practical approach to disinfection of pruning tools during field operations using isopropanol-impregnated disinfectant wipes such as 'Azo Wipes' has been identified.

Background and objectives

Bacterial canker of *Prunus* species has been an on-going problem for HNS growers for many years and also causes losses to stone fruit growers. It was identified as a major concern during a survey of bacterial diseases of HNS in 1996-97 (HNS 71)

Bacterial canker may be caused by two distinct pathovars (pv.) of *Pseudomonas syringae*: pv. *morsprunorum* (*Psm*) and pv. *syringae* (*Pss*). *Psm* is host specific to *Prunus* species, whereas *Pss* has a much wider host range, with the potential for cross infection between a number of different species and genera. Although the stem canker phase is the most economically important, these pathogens also cause leaf spots/shot-holes, bud death, shoot die-back and flower blights. 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. Thus cankers may not be observed until 18 months after the initial infection has taken place.

For many years (based on work done at East Malling in 1950's and 60's), *Psm* was considered to be the primary cause of the disease in the UK. During a MAFF-funded survey of 'Farm Woodland' cherries, led by the author, in 2001-02, it became clear that both pathogens were causing canker in England, it was also clear that trees were already contaminated with the pathogen on the nursery.

It is generally considered that the most effective way to control bacterial diseases is by an avoidance strategy, i.e. avoiding the introduction or carry-over of inoculum. Such a strategy

can usually be implemented effectively for seed-raised annual crops, but presents considerable challenges for vegetatively propagated perennials.

Growers are aware that good hygiene practices are important, and that secateurs/pruning knives, etc. should be disinfected, but the most practical and effective method(s) to achieve this are not clear.

The overall aim of the project was to identify management options which will be of benefit in the control of bacterial canker of *Prunus* species. To achieve this the project aimed to identify the main sources of primary inoculum on propagation nurseries; examine the potential of targeted treatments to reduce/eliminate inoculum; examine the relative merit of different practical approaches for cleaning/disinfection of pruning knives/secateurs; and critically review relevant scientific and advisory literature and draw together with the new experimental work to produce a fact-sheet with clear practical recommendations. This final report summarises the results for all three years of the project.

Summary

Spray trials and epidemiology

Spray trials were located at two commercial tree production nurseries in the UK (England), one in the South and one in the Midlands. Following discussions with grower co-ordinators two rootstocks (Saint Julien A and Colt) and three scions (plum cultivar Victoria; cherry cultivars Stella and Kiku-shidare Sakura) were selected for the experimental work. The stock hedges used to produce cuttings for rootstocks and the mother plants used to produce bud-wood for grafting were located at one nursery. The rootstocks were planted, budded, and grown-on at both nurseries.

Six (five plus an untreated control) different treatments were examined for their effects on leaf and bud populations of the bacterial canker pathogens and also on development of canker and die-back symptoms (in the final year). The treatments are shown in Table 1. Three treatments were consistent throughout the three years: (A) Cuprokylt (copper oxychloride) + wetter (Activator 90); (B) the bio-pesticide Serenade ASO (*Bacillus subtilis* strain QST 713); (E) Cuprokylt + Dithane NT (mancozeb) tank mix (this mix is widely used in France and Australia for control of bacterial pathogens of stone fruits and nuts). Two treatments varied from year to year as a result of product withdrawals and review of the results of the previous years: (C1) Bactime Cu L4F (glucohumate + copper) in 2010 was replaced by (C2) Cuprokylt alternating with Serenade ASO in 2011 and 2012; (D1) Aliette 80WG (fosetyl-aluminium) in 2010 was replaced by (D2) Cuprokylt + Dithane NT mix plus wetter in 2011 and by (D3) Cuprokylt plus sticker (Nu-Film P) in 2012. Bactime Cu L4F (C1)

was replaced as pathogen levels were worse than in the untreated samples. Aliette 80WG (D1) was replaced as it was being withdrawn from the market.

Applications were made according to the following timings and key growth stages: 2 x spring, as soon as possible after bud burst; 2 x summer, prior to budding; 2 x autumn sprays. Approximately 12 individual stock hedge plants, 2-3 mother plants and 100 rootstocks or maidens were allocated to each treatment.

Table 1. Treatment codes, products and rates used in spray trial.

Code	Product	Active ingredient	Rate	Approval status
A	Cuprokylt + wetter (Activator 90)	Copper oxychloride	3 g/L Cuprokylt + 0.25 mL/L Activator 90	Label approval
B	Serenade ASO	Bacillus subtilis	10 mL/L	EAMU for ornamental plant production
C1	Bactime Cu L4F (Year 1)	Copper + glucohumate	4 g/L	N/A - foliar fertiliser
C2	Cuprokylt followed by Serenade (Years 2 and 3)			
D1	Aliette 80WG (Year 1)	Fosetyl-aluminium	1 g/L	No longer approved
D2	As E + Activator 90 (Year 2)			
D3	Cuprokylt + sticker (Nu-Film P) (Year 3)	Copper oxychloride	3 g/L Cuprokylt + 0.3 mL/L Nu-Film P	Label approval
E	Dithane NT + Cuprokylt	Mancozeb + copper oxychloride	2 g/L Dithane NT + 3 g/L Cuprokylt	Dithane NT – LTAEU Cuprokylt – Label approval
U	control, no treatment	N/A	N/A	N/A

Leaf and bud samples were collected from each treatment from each nursery during the growing season and taken to the laboratory for processing. Sampling visits were timed to occur shortly after sprays had been applied. Samples were extracted, diluted and plated onto semi-selective agar media to determine the presence or absence and numbers of *Psm* and *Pss.* The identities of the bacteria were confirmed by cultural, biochemical and (in the case of *Pss*) host tests.

Approximately 750 samples were collected over the three years. Both bacterial canker pathogens were isolated from samples at both nurseries throughout the year. The main conclusions can be summarised as follows:

- Levels of *Psm* and *Pss* were reduced by sprays containing Cuprokylt.
- The most consistent effects were obtained with Cuprokylt plus a wetter (Activator 90).
- There was no consistent benefit from mixing Cuprokylt with Dithane NT compared to Cuproklyt plus wetter.

- There was no benefit from using a sticker (Nu-Film P) rather than wetter (Activator 90).
- There was no benefit from Serenade ASO or alternating Serenade ASO and Cuprokylt compared to Cuprokylt alone.
- Levels of both *Psm* and *Pss*, but especially *Psm* were greater on plum than on cherry.
- The overall levels of pathogens varied from year to year and with the time of year: levels of *Psm* tended to be higher in spring and summer, levels of *Pss* were higher in spring and autumn

Disinfection of pruning tools

The cutting edges of secateur blades or 'Stanley' knife blades were contaminated with a standard amount of a known strain of *Psm.* An attempt was then made to disinfect the blades by one of several methods (Table 2). Following 'disinfection' each blade was then used to make ten cuts in a plate of agar medium. Disinfection efficiency was then assessed on the basis of the number of cuts in the agar with bacterial growth. Results are summarised in Table 2.

Table 2. Summary of disinfection tests. Each replicate consisted of ten sequential cuts following disinfection of the contaminated blade. The percentage is the number of cuts giving bacterial growth: the lower the percentage the better the treatment.

Code	Detail	Replicates	% cuts (5×10^7)[a]	% cuts (1×10^6)[b]
U	Untreated control.	20	99.9	99.3
SW	Spray with 70% iso-propanol, leave 30 s then wipe dry with paper towel.	20	16.9	0.8
SW2	Spray with 70% iso-propanol, wipe residue, repeat spray leave 30 s then wipe dry.	3	1.1	0.0
W	Wipe with Azo wipes (70% iso-propanol).	8	8.6	0.4
J5_0	Brief dip in Jet 5 (0.8%) then wipe dry.	19	48.2	3.4
J5_15	15 s dip in Jet 5 (0.8%) then wipe dry.	6	0.0	0.0
J5_30	30 s dip in Jet 5 (0.8%) then wipe dry.	7	0.3	0.0
Cl_0	Brief dip in 1% chlorine then wipe dry.	7	24.4	1.2
Cl_30	30 s dip in 1% chlorine.	1	0.0	0.0
GW	Rub edge of blade with alcohol hand gel between finger and thumb, wipe dry.	11	51.1	3.8

[a] Predicted % cuts with growth, adjusted to a standard inoculum concentration of 5×10^7 CFU/mL
[b] Predicted % cuts with growth, adjusted to a standard inoculum concentration of 1×10^6 CFU/mL

During the first rounds of testing done in 2010, we failed to identify a practical option for disinfection in the field. Given the wider potential importance of disinfection of pruning tools,

further experiments were done in 2011 with lower inoculum concentrations and shorter drying times.

At lower inoculum doses and with shorter drying times, the efficacy of all treatments improved, and all gave significant reductions in potential pathogen transfer compared to the untreated control. Conversely, the level of disinfection achieved was reduced as inoculum increased and when drying was fan-assisted. Although long (30 second) dips in disinfectants (chlorine or Jet 5) were the most effective, these are not practical to implement in the field. Hence, whilst not the most effective when bacterial inoculum levels are high or when it is dried on, regular use of disinfectant wipes (impregnated with 70% iso-propanol as the active ingredient) are probably the most practical option for use in the field. The Azo Hard Surface Wipes used in the tests and similar products are readily obtained from a number of suppliers, especially medical and clean-room suppliers. In addition, because such an approach is easily implemented and so more likely to be applied, it seems likely that the benefits of more frequent use may outweigh the lower efficiency compared to other methods.

Financial benefits

Current industry estimates indicate potential losses from bacterial canker during nursery production and soon after final planting in the range £125,000 to £200,000 per annum. Based on current (April 2013) prices for Cuprokylt of £165 for 25 kg and Activator 90 of £29 for 5 L, the cost of six applications per annum would be less than £128 per ha, plus the labour cost of application.

Action points for growers

- Disinfect pruning tools and knives as often as possible in the field using iso-propanol impregnated wipes such as 'Azo Wipes'.
- Copper sprays in the form of Cuprokylt + wetter (Activator 90) are still the most effective chemical control option available for bacterial canker. Other products containing the same active ingredient (copper oxychloride) would be expected to be equally effective, but were not tested in this project, and may be more limited in terms of the number of applications that can be applied.
- The highest levels of *Psm* were seen in the spring and summer, thus the current label recommendations for three sprays in late summer may be starting too late to have a significant impact, and spray applications should start in the spring