



Grower Summary

CP 174

Review of bacterial
pathogens of economic
importance to UK crops

Final Report, August 2017

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Location of project: Warwick, York

Industry Representative: N/A

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GROWER SUMMARY

Headline

- This report lists over 100 known bacterial plant pathogens that affect or could potentially affect UK crops.
- The recent literature on control of a number of key host-pathogen groups have been reviewed.

Background

Bacterial diseases cause sporadic but often severe problems for UK growers. Bacterial pathogens known to affect or that could potentially affect UK crops have been listed. Following industry feedback, the currently recommended/approved and potential control measures for a range of bacterial plant pathogens prioritised as the most economically important to horticulture, cereals & oilseeds and potato sectors, have been reviewed. In addition we have also summarised the results of HDC/AHDB trials examining sprays, disinfectants and seed treatments for the control of bacterial diseases.

Summary

HDC/AHDB-Horticulture have funded 30 projects on bacterial diseases since its inception. Around 23 separate spray trials have targeted bacterial diseases, together with three examining seed treatments. The main conclusions are summarised below.

Biosecurity – prevention is better than control

- The industry should be more pro-active in seeking management/control options that do not rely on plant protection products (PPPs).
- Growers need to be made much more aware that there is much that can be done to control bacterial diseases without the use of PPPs. However, this requires effort in the absence of easily discernible benefits, prevention is better than cure.
- Disease avoidance through the use of clean, i.e. pathogen-free (note disease-free is not necessarily pathogen-free) starting material (i.e. seed, cuttings, tubers) is the most effective strategy for controlling most bacterial diseases.
- Control through disease avoidance requires effective standard procedures for plant health and biosecurity, based on a thorough knowledge of the primary sources and epidemiology of particular diseases (a neglected area for a number of important pathogens).

- Research should initially focus on understanding the fundamental biology and epidemiology of key pathogens where this information is lacking (e.g. bacterial rots, spear rot). It should be noted that in the last twenty years, no new plant protection products for bacterial diseases have been identified in spray trials.
- Many 'new' diseases have been introduced with contaminated plant material and or have resulted from changes to production practices.
- Good hygiene and disease avoidance has been shown to be a very effective way of preventing diseases caused by bacteria in the hospital setting (e.g. Clostridium difficile [C. diff], methicillin-resistant Staphylococcus aureus [MRSA]). This has required significant management support to educate and drive cultural changes amongst the workforce. Taking analogous approaches may have some benefits.
- Growers/consultants are often reluctant to send samples for diagnosis, often waiting until control with standard fungicides has failed, when further action is often ineffective. Growers should be encouraged to obtain a clinic diagnosis of unidentified diseases at an early stage.
- Chemical control – availability and future prospects
- A major issue for the future commercial development of any PPPs specifically for bacterial plant disease is the relatively limited market size in the developed world; it does not justify the cost of development and registration.
- Discovery of a 'cure-all' PPP to control bacterial diseases is unlikely.
- 'Cure-all' PPPs are attractive as they enable the user to feel like they are doing something tangible, the reality is different.
- In most cases, spraying crops affected by bacterial diseases, after symptoms have become apparent, is ineffective.
- For some bacterial diseases, copper oxychloride (and other copper sprays) have consistently been shown to be effective in a number of trials. Due to EU legislation changes, approvals are currently under review and scope for its use is currently very restricted. Although this may change, growers and the industry should continue to lobby to ensure that copper oxychloride is available in the future.
- Permitted future use of copper oxychloride may come with increased restrictions, it will be vital to ensure that it is used in the most effective way, whilst limiting the likelihood of resistance developing.

- Improvements in bacterial disease control are most likely to result from a series of small incremental changes, rather than identification of a novel chemical pesticide.
- Biological control – availability and future prospects
- During the last 20 years, there are many examples from research of promising disease reductions resulting from the application of Biological Control Agents (BCAs), mostly antagonistic bacteria. To date agents for control of only two specific bacterial diseases have been commercialised: NOGALL (*Rhizobium rhizogenes* K-84 against crown gall and BlightBan A506 (*Pseudomonas fluorescens* A506), BlightBan C9-1 (*Pantoea agglomerans* C9-1), Bloomtime (*Pantoea agglomerans* E325), Blossom Bless (*Pantoea agglomerans* P10c) and BioPro (*Bacillus subtilis* BD170) against fireblight. There are also two products that are approved for control of fungal diseases that may provide some general suppression of bacterial plant pathogens: Serenade ASO (*Bacillus subtilis* QST713) and Amylo-X (*Bacillus amyloliquefaciens* subsp. *plantarum* D747).
- Biological control with antagonists or phage is often perceived as the most sustainable way forward in the long term. However, the regulatory environment and cost of registration is limiting their economic feasibility for most crops, due to the specificity of BCA/host/pathogen interactions, which are often strain specific.
- Effective phage therapy is already being demonstrated for some diseases (e.g. bacterial soft rot) with commercial products emerging. Phage exist with specific activity against most bacterial plant pathogens and their potential for disease control merits further investigation across the sectors. This should include research on the ecology of phage to demonstrate efficacy, safety and lack of any adverse, unintended effects.
- Is there a way forward for approval of phage in the same way as a 'commodity' substance thereby enabling a rapid discovery to deployment pipeline for individual crops/pathogen strains?
- Resistance – availability and future prospects
- Resistance to bacterial diseases is a major goal for sustainable and affordable plant protection. Whilst it has been difficult to develop through conventional breeding, there are some examples of useful levels of resistance in varieties and cultivars of a number of vegetable crops and ornamentals. Careful variety selection should be an important consideration where a risk of bacterial disease exists.
- As the biological mechanisms of plant-pathogen interactions is increasingly understood, many targets for marker assisted selection are becoming available which should direct a more efficient strategy for plant breeding.

- Similarly, there are now a number of feasible targets for introduction of transgenic resistance to bacterial diseases into modern cultivars, whilst maintaining favourable quality and yield characteristics.

KE and Factsheets

Suggested updates or additional factsheets needed:

22/12 Spear rot on calabrese – update and factual corrections (in progress).

12/12 Black rot of brassicas – update needed (in progress).

03/14 Disinfectants in protected ornamentals – missing results from HNS 91 (or alternatively new factsheet on Disinfectants for bacterial diseases).

Managing the risk of blackleg and soft rot – update with results from recent and current projects.

Scab on field vegetables – new.

Crown gall and root rot – new.

Bacterial blotch of mushroom – new.

Minor issues:

26/12 Bacterial diseases in protected ornamentals – information on ivy not correct? (ref HNS 92), disinfectant results from HNS 91 not included.

Financial Benefits

The total cost to UK industry resulting from bacterial plant diseases is difficult to estimate and will vary greatly for different crops and production systems and according to climatic conditions both within and between years. This review aimed to compile current industry data on economic losses due to specific bacterial diseases of key importance to each sector so that they can be ranked in order of priority. Information on efficacy and availability of different control methods has been compiled in facilitate knowledge exchange across the various industry sectors. This will help to promote common practices and treatments which decrease risk and impact of bacterial diseases as well as to prioritise future research where effective controls are missing or support is needed

Action Points

See summary.