Grower Summary

Improved management of bacterial diseases of horticultural crops

CP 191

Final report 2022

Project title:	Improved management of bacterial diseases of horticultural crops
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Project leader:	Dr S J Roberts, Plant Health Solutions Ltd
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Location of project:	Warwick, Cawood, various grower sites
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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

A range of studies over two years and across a range of eight different edible and ornamental plant species reinforced the critical importance of using healthy (pathogen free) planting material (seeds, cuttings, plug plants, liners) for the management of bacterial plant diseases.

Background

There are more than 100 known bacterial plant pathogens that affect, or could potentially affect, UK crops. Despite much previous research, diseases caused by bacterial pathogens continue to cause economic losses to growers, particularly in field vegetables, hardy nursery stock and protected ornamentals. The options for control with plant protection products have always been limited, and it is likely that this will continue. For the majority of bacterial plant diseases the primary source of infection is likely to be the seed or propagation material. The use of clean starting material provides the best prospects of long-term sustainable control of bacterial pathogens in horticultural crops; the exclusion of the pathogen through the use of clean starting material avoids the need for secondary interventions with e.g. Plant Protection Products etc. This collaborative project between Plant Health Solutions (PHS), Stockbridge Technology Centre (STC), Warwick Crop Centre (WCC) and growers and primarily focussed on developing best practice for the deployment of such a strategy. For a number of high priority model bacterial pathogens, the prevalence of the pathogen in starting material was determined, the benefits of clean starting material was demonstrated, and epidemiological data was obtained to set health standards for starting material. We also examine the feasibility of novel methods to produce high-health planting material as a second-line defence, and examined the potential for resistance deployment where this seemed feasible.

Summary

Brassicas and Black Rot

- Seed testing revealed several seed lots infested with *Xanthomonas campestris* pv. *campestris* (*Xcc*)
- *Xcc* was detected in several batches of transplants, where traced these were found to be derived from infested seed.

- More than 50 crops/locations have been walked/examined and levels of black rot assessed. High levels of disease in the field were associated with known infested seed lots or transplants.
- The use of high-health transplants resulted in reduced levels of black rot and increased yields, compared to conventionally produced transplants in the same field.
- Hot water seed treatment resulted in significant reductions in disease levels in the field compared to crops derived from untreated seed of the same seed lot.
- Whether or not the previous (brassica) crop was infected with black rot had little impact on disease levels compared to seed infestation.
- The risk of significant disease developing as a result of field carry-over between crops appears small compared to the risk from seed infestation.
- Significant field outbreaks of black rot are likely to be the result of failure of seed (suppliers) to meet the recommended health standard of <0.005%.

Broccoli spear rot

- Despite inoculation of transplants with pathogenic strains, no disease developed in two years of field trials to screen for the resistance.
- We were able to demonstrate both seed to seedling transmission and spread of the pathogen during plant-raising.
- The relative importance of seed infestation in driving epidemics remains to be clarified.

Coriander and parsley bacterial blight

- *Pseudomonas syringae* pv. *coriandricola* was detected in three out of four seed lots tested. The levels detected exceeded the recommended health standard.
- Significant field outbreaks of black rot are likely to be the result of failure of seed (suppliers) to meet the recommended health standard.
- We were unable to isolate any specific bacterial pathogen from parsley field samples.

Cherry laurel and bacterial shot-hole

- Forty-four sub-samples (8 batches) of mother-plants/liners were tested at potting. The pathogen, *Pseudomonas syringae* pv. *syringae* (*Pss)* was detected in four batches with levels ranging from 0.5 to 2.7%.

- Follow-up of resulting crops indicated higher levels of disease in batches in which *Pss* was detected.
- Micro-propagation of *Prunus lauroceraus* cv. Otto Luyken was successful. Plants were established in tissue-culture and a batch was transferred to a commercial tissue-culture company for further multiplication. These were successfully weaned and grown on. Initial testing of potted plants indicates that they are pathogen-free.

Hardy Geraniums and Xanthomonas leaf spot

- *Xanthomonas hortorum* pv. *pelargonii* (*Xhp*) was detected in several batches of plug plants upon delivery to a production nursery.
- Spiking sample extracts with known numbers of *Xhp*, suggests that detection failures may occur when background bacterial populations are relatively high and pathogen populations low.
- BioPCR testing of plug plants indicated that many batches of plug plants could be infested with low numbers of *Xhp*, that were not detected by conventional plating.
- Infected batches of plants that were overwintered had high levels of disease in the following spring. Such batches of plants likely provide an important additional inoculum source for current year's material.
- Disease incidence increased very rapidly on the production nursery in June 2020. The estimated r-values (apparent infection rate) were 0.12 to 0.22 per day.
- In an experiment to compare the effect of irrigation systems on the rate of disease spread from a single point source, no spread of disease or pathogen was detected in plants grown under protection with sub-irrigation. For plants grown outdoors with overhead irrigation, disease incidence increased from 0.8% to 21.4%, and the pathogen was detected on all symptomless plants sampled. The r-value (apparent infection rate) was 0.031 per day.
- Based on the r-value from the spread experiment a health standard of <0.032% would need to be achieved in plug plants to ensure disease incidence did not exceed 10% by the end of a 6-month growing season.

Hedera and Xanthomonas leaf spot

- *Xanthomonas hortorum* pv. *hederae* (*Xhh*) was detected in several batches of liners at the point of delivery to the nursery.

- In an experiment to compare the effect of irrigation systems on the rate of disease spread from a single point source, no spread of disease or pathogen was detected in plants grown under protection with sub-irrigation. For plants grown outdoors with overhead irrigation disease incidence increased from 0.8% to 21.4%, and the pathogen was detected on all symptomless plants sampled. The r-value (apparent infection rate) was estimated at 0.036
- Based on the r-value from the spread experiment a health standard of <0.013% would need to be achieved in plug plants to ensure disease incidence did not exceed 10% by the end of a 6-month growing season.

Delphiniums and bacterial blotch

- Forty-four sub-samples of plug plants representing 14 batches from a range of suppliers were tested for *Pseudomonas syringae* pv. *delphinii* in 2020. The pathogen was not detected in any batches.
- No disease was detected in follow up of batches in production.

Novel Production System

- A quasi ebb and flood system for producing module transplants or plug plants using only sub-irrigation was trialled at a commercial plant-raising nursery.
- Brassica transplants in 345 module trays were successfully produced using the system and both plant-raiser and end-user grower were happy with the quality of the plants.
- The system needed less watering and feeding than conventional production.
- The resulting plants out-yielded conventionally produced plants of the same variety planted in the same field.

Financial Benefits

Production of high-health kale transplants using a quasi ebb-and-flood system resulted in a significant reduction in disease and concomitant yield increase of 2 to 6 t/ha in Cavolo Nero kale. Based on Defra price for curly kale of £3.40 per kg, this is equivalent to a value of £6,800 to £20,400 per ha. There are no Defra statistics for UK kale production, but if we assumed this to be 1,000 ha, then the national value of the gain would be £6 to £20 million. Perhaps more importantly reduction in losses and crop write-offs in the UK would reduce the need for and cost of imports.

Action Points

- Growers should question suppliers of seed and young plants on the health standards that have been applied and request assurances that those standards have been achieved.
- It is essential to quarantine and check bought-in plant material carefully and if necessary, consider additional laboratory testing.
- Consider production of modules, plug-plants, liners with a sub-irrigation system.
- Avoid or minimise the use of overhead irrigation in production.