



Department
for Environment
Food & Rural Affairs

Pest specific plant health response plan:

Outbreaks of *Ralstonia solanacearum* (potato brown rot) in potato crops



Figure 1. Potato infected with *Ralstonia solanacearum*, displaying brown staining of the vascular tissue and bacterial ooze © Fera Science Ltd.

We are the Department for Environment, Food and Rural Affairs. We are responsible for improving and protecting the environment, growing the green economy, sustaining thriving rural communities and supporting our world-class food, farming and fishing industries.

We work closely with our 33 agencies and arm's length bodies on our ambition to make our air purer, our water cleaner, our land greener and our food more sustainable. Our mission is to restore and enhance the environment for the next generation, and to leave the environment in a better state than we found it.



© Crown copyright 2026

This information is licensed under the Open Government Licence v3.0. To view this licence, visit www.nationalarchives.gov.uk/doc/open-government-licence/

This publication is available at

<https://planthealthportal.defra.gov.uk/pests-and-diseases/contingency-planning/>

This contingency plan takes into account the environmental principles laid out in the [Environment Act 2021](#). Of particular relevance are:

The prevention principle, which means that any policy or action taken, or not taken should aim to prevent environmental harm.

The precautionary principle, which assists the decision-making process where there is a lack of scientific certainty.

Any enquiries regarding this document should be sent to us at:

The UK Chief Plant Health Officer

Department for Environment, Food and Rural Affairs

Room 11G32, York Biotech Campus

Sand Hutton

York

YO41 1LZ

Email: plantpestsrisk@defra.gov.uk, Website: www.gov.uk/defra

Executive summary

Background	
Regulation	GB Quarantine Pest
Key Hosts	Potatoes, tomatoes and other solanaceous plants
Distribution (Appendix A)	Widespread in South America, present in potato producing regions of Africa, Asia, Europe and Oceania
Key pathways	Seed and ware potatoes, infected produce
Industries at risk	Ware and seed potato production
Symptoms (2.3)*	• Leaves and shoots can wilt, particularly during the warmest part of the day, plants can fail to recover leading to necrosis and mortality • When stems are cut, a bacterial ooze can be observed alongside discoloration of the vascular tissue • Symptoms in potato tubers can include bacterial ooze at eyes, stolon end, and cut surface of vascular ring. The vascular ring may also show brown discolouration.
Surveillance	
Demarcated zones (5.43-5.50)	• Established based on the designation of infested and probably infested tubers, plants, other material, and the potential for spread
Surveillance activities (5.18, 5.43)	• Visual surveillance of crops, testing of lots and water sampling will be carried out to guide future surveillance and designation of infested and probably infested tubers or plants, places of production, watercourses and other premises handling potatoes, machinery, vehicles, vessels, stores and any other objects including packaging material • Latent testing of tuber stocks with links to infected tubers
Response measures	
Interceptions (5.1-5.8)	• The consignment should be destroyed if <i>R. solanacearum</i> is confirmed • Contaminated vehicles, equipment etc., should be cleansed and disinfected • Tracing exercises should be carried out where required • A notification via the UK Plant Health Interception Notification System should be made
Outbreaks (5.51-5.76)	• Destruction of growing plants, and if progeny tubers have formed these should be harvested and disposed of • Any other harvested tubers must be destroyed • Contaminated vehicles, equipment etc., should be cleansed and disinfected • Volunteer potato plants and other hosts should be controlled • Irrigation restrictions
Key control measures	
Biological	N/A
Chemical	Herbicide applications
Cultural	Cleaning of contaminated equipment and machinery, removal and destruction of infected tubers, plants and waste. Prohibiting use of infected water courses for irrigation or spraying.
Declaration of eradication	
Eradication can be declared after at least 6 years if infested fields are left in bare fallow, or after at least 7 years if fields are not left in bare fallow. See section 6.1.	

* Numbers refer to relevant points in the plan

Contents

Executive summary	3
Glossary of terms (from ISPM 5)	4
1. Introduction and scope	5
2. Summary of the threat	5
3. Risk assessments	7
4. Actions to prevent outbreaks	7
5. Response	8
Official action to be taken following the suspicion of an interception of <i>R. solanacearum</i> ...	8
Official action to be taken following the confirmation of an interception of <i>R. solanacearum</i>	8
Official action to be taken following the suspicion of a <i>R. solanacearum</i> outbreak	9
Confirming a new outbreak	12
Criteria for determining an outbreak	16
Official action to be taken following the confirmation of an outbreak	17
6. Criteria for declaring eradication / change of policy	25
7. Evaluation and review of the contingency plan	26
8. Appendix A	27
Datasheet for <i>Ralstonia solanacearum</i>	27
9. References	35
10. Authors and reviewers	37

Glossary of terms (from ISPM 5)

Place of production - Any premises or collection of fields operated as a single production or farming unit.

Production site - A defined part of a place of production, that is managed as a separate unit for phytosanitary purposes.

1. Introduction and scope

- 1.1. This pest specific response plan has been prepared by the Defra Risk and Horizon Scanning team. It describes how the Plant Health Service for England will respond if an outbreak of *Ralstonia solanacearum* is discovered in new locations in a potato crop which causes brown rot of potato. A separate plan is available outlining the response plan for outbreaks of *R. solanacearum* in tomato crops.
- 1.2. The plant health authorities in Northern Ireland, Wales and the Crown dependencies have been consulted on this plan and will use it as the basis for the action they will take in the event of *R. solanacearum* being detected in their territories.
- 1.3. Scotland has its own contingency plan for *R. solanacearum*, which closely aligns with this plan: <https://www.sasa.gov.uk/document-library/sg-contingency-plan-potato-brown-rot>.
- 1.4. This document will be used in conjunction with the Defra Generic Contingency Plan for Plant Health in England (<https://planthealthportal.defra.gov.uk/pests-and-diseases/contingency-planning/>), which gives details of the teams and organisations involved in pest response in England, and their responsibilities and governance. It also describes how these teams and organisations work together in the event of an outbreak of a plant health pest.
- 1.5. The aims of this response plan are to facilitate the eradication of *R. solanacearum* in a potato crop and to make stakeholders aware of the planned actions.

2. Summary of the threat

- 2.1. *Ralstonia solanacearum* can persist in both the soil and water, it is a Gram-negative, motile bacterium which has been shown to infect a wide range of both cultivated and wild hosts. Hosts of particular economic importance to the UK are the solanaceous crops such as tomato, potato and peppers (EPPO 2025b).
- 2.2. This plan focuses on *R. solanacearum sensu stricto* the causal agent of potato brown rot and is based on the EPPO Standard on a national regulatory control system for *R. solanacearum* (EPPO 2023). Measures outlined in this plan could be used as the basis to control other species, in particular *R. pseudosolanacearum* which has become more prevalent within Europe in recent years (EPPO 2025a). Previously *R. solanacearum* was subdivided into four Phylotypes which sat within the wider *R. solanacearum* species complex (RSSC) (Fegan & Prior 2005). Subsequent reclassification resulted in the replacement of the four Phylotypes with three species: *R. solanacearum* (previously Phylotype II), *R. pseudosolanacearum* (previously Phylotype I and III) and *R. syzygii* (Phylotype IV) (Safni *et al.*, 2014).

- 2.3. *Ralstonia solanacearum* is thought to have originated in Central and South America, which is where the largest diversity of genotypes is present (EPPO 2025b). *Ralstonia solanacearum* is present in certain watercourses in England and as the bacterium can spread through surface water, restrictions are in place on irrigation from waterways which are under official control. More details on specific watercourses can be found on: <https://www.gov.uk/guidance/plant-health-controls#potato-brown-rot>. Isolated outbreaks of *R. solanacearum* have occurred in ware potato crops in England between 1992 and 2010, as well as an outbreak in tomato crops in two adjacent glasshouses in 1997 and 1998 (EPPO 1997). The outbreak in tomato and all but one in potato were caused by the irrigation of crops with contaminated river water. The most recent outbreak in potato in 2010, was caused by importing infected seed potatoes (Allen & Lindley-Klassen 2023).
- 2.4. *Ralstonia solanacearum* can be spread unintentionally, because of latent infections. Symptoms in potato plants include wilting of leaves and shoots, particularly during the warmest part of the day, although plants may show recovery at night (EFSA 2019a). In cool climatic conditions plants may not exhibit above ground symptoms at all. After severe wilting, plants can fail to recover leading to necrosis and mortality. When stems are cut a bacterial ooze can be observed alongside discoloration of the vascular tissue (EFSA 2019a). Symptoms in tubers include emergence of bacterial ooze from the eyes and stolon end. Cut tubers may show a brown ring and creamy fluid exudate on the vascular ring at the cut surface (EFSA 2019b).
- 2.5. The bacterium can be spread by infected vegetative propagating material of host plants which span many food crops and ornamental species (see appendix A for full host list). This is especially problematic for unintentional spread in some ornamental species, such as *Rosa* sp. can be asymptomatic (Blom *et al.*, 2024). This is unlike *Clavibacter sepedonicus* (potato ring rot) which only has *S. tuberosum* as a major host. Another pathway for entry is through the release of contaminated processing and wash water of imported infected potatoes, or other produce, into watercourses. The population of *R. solanacearum* can be sustained on wild hosts which grow on riverbanks such as *Solanum dulcamara* (bittersweet or woody nightshade), these act as a continuing source of contamination in the water. If water from contaminated watercourses, is used for irrigation or spraying of susceptible crops, outbreaks can occur. Historically, this has been the main cause of outbreaks in England as, once *R. solanacearum* has contaminated a watercourse with wild hosts present, eradication is extremely difficult. Therefore, irrigation and spraying with water from watercourses designated as infested is officially prohibited, unless a validated method for obtaining pathogen-free water is used and licensed by the Animal & Plant Health Agency (APHA). Irrigation of seed potato crops will not be permitted regardless of any measures taken (Elphinstone & Matthews-Berry 2017).

3. Risk assessments

- 3.1. *Ralstonia solanacearum* has unmitigated and mitigated UK Plant Health Risk Register (UKPHRR) scores of 100 and 30, respectively. Overall scores range from 1 (very low risk) to 125 (very high risk). These scores are reviewed as and when new information becomes available (<https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/viewPestRisks.cfm?cslref=11066>).
- 3.2. The UKPHRR rates the impact of the bacterium to the UK to be very high.
- 3.3. The European Food Safety Authority (EFSA) published a scientific opinion on the pest categorisation of the RSSC in 2019, which concluded that losses due to the RSSC would be extremely high if epidemics were to occur in the EU (EFSA 2019b). EFSA noted that this is likely the case for all phylotypes/species within the complex.
- 3.4. *Ralstonia solanacearum* is on the EPPO A2 list and is therefore recommended for regulation by EPPO member countries.

4. Actions to prevent outbreaks

- 4.1. *Ralstonia solanacearum* is a GB Quarantine Pest listed in [Annex 2](#) part B of [the GB Phytosanitary Conditions Regulations 2019/2072](#), and is therefore prohibited from being introduced into, moved within or held, multiplied or released into GB. Further pest and host specific requirements are listed in [Annex 6](#), [Annex 7](#) and [Annex 8](#). *Ralstonia pseudosolanacearum* and *R. syzygii* (as *R. syzygii* subsp. *celebesensis* and *R. syzygii* subsp. *indonesiensis*) are also listed as GB Quarantine Pests in [Annex 2](#) Part A of [2019/2072](#).
- 4.2. As *R. solanacearum* is present in some UK watercourses the restrictions mentioned in 2.3 and continuing surveillance on potato, tomato and surface water also helps to prevent outbreaks. This surveillance is performed using a risk-based approach to provide assurance the whole production system is pest free.
- 4.3. The Plant Health Service for England (including APHA, Defra and Fera Science Ltd.) should be aware of the measures described in this plan and be trained in responding to an outbreak of *R. solanacearum*. It is important that capabilities in detection, diagnosis, and risk management are available.

5. Response

Official action to be taken following the suspicion of an interception of *R. solanacearum*

- 5.1. If *R. solanacearum* is suspected by the Plant Health and Seeds Inspectorate (PHSI) to be present in a consignment moving in trade, the PHSI must hold the consignment until a diagnosis is made. Any opened containers should be resealed. Other consignments that are at risk of cross-contamination should also be held prior to a risk assessment on whether cross-contamination has or could have potentially occurred. Samples should be sent by the PHSI immediately to Fera Science Ltd., Plant Clinic, York Biotech Campus, Sand Hutton, York, YO41 1LZ (0300 100 0323) in a sealed bag or container, within at least two other layers of containment, which are not liable to be crushed during transit.
- 5.2. Screening tests for *R. solanacearum* include isolation, or molecular tests in line with EPPOs PM 7/21 (3) Diagnostic Standard (EPPO 2022). Fera Science Ltd. will inform Defra of any suspicious test results. Subsequent tests to confirm the identity of *R. solanacearum* will be performed which can include Fatty Acid Profile analysis, molecular tests, DNA barcoding, and Matrix-assisted laser desorption/ionization time of flight mass spectrometry (MALDI-TOF). The diagnostic standard presents a detailed flow diagram describing the diagnostic procedure, although it is important to note that when two tests are required at a given stage these should be based on different biological principles or target different parts of the genome.
- 5.3. All other material, not including consignments which may have become cross contaminated in 5.1, that has had contact with the suspected consignment, such as equipment, vehicles, machinery, storage facilities and washings, should also be designated as infested until testing has been completed.

Official action to be taken following the confirmation of an interception of *R. solanacearum*

- 5.4. When infection with *R. solanacearum* is confirmed, the PHSI should advise the client of the action that needs to be taken by way of an official plant health notice.
- 5.5. The consignment should be destroyed by either incineration, deep burial or one of the other methods described in point 5.57. If it is not possible to organise destruction via one of these methods, a suitable alternative should be discussed with the Defra Risk and Horizon Scanning team.

- 5.6. Contaminated materials, such as equipment, vehicles, machinery, storage facilities and washings should be disinfected as in point 5.58.
- 5.7. An UKPHINS (UK Plant Health Interception Notification System) notification should be made upon confirmation of an interception of *R. solanacearum*. UKPHINS is the IT system for recording findings and non-compliance to maintain records and to notify other National Plant Protection Organisations (NPPOs) of plant health issues.
- 5.8. If all or part of the consignment has not been held and has been distributed to other premises prior to diagnosis, trace forward and trace back inspections should take place upon suspicion or confirmation of *R. solanacearum*. Details of recent, past and future consignments from the same grower/supplier should also be obtained and a decision on action taken on a case-by-case basis.

Official action to be taken following the suspicion of a *R. solanacearum* outbreak

- 5.9. Suspected outbreaks will be assessed on a case-by-case basis. An Outbreak Triage Group (OTG), chaired by the Chief Plant Health Officer (CPHO) or their deputy, including specialists from APHA, Defra and other organisations, should be set up to assess the risk and decide on a suitable response. Where appropriate, the OTG will also decide who will be the control authority (the lead organisation responsible for the eradication or containment of the pest), and the control authority will then nominate an Incident Controller. For an outbreak of *R. solanacearum*, APHA will likely be the control authority. An Incident Management Team (IMT) meeting, chaired by the Incident Controller, will subsequently convene to produce an Incident Action Plan (IAP) to outline the operational plan. See the [Defra Generic Contingency Plan for Plant Health in England](#) for full details.
- 5.10. The OTG will determine an alert status, which will consider the specific nature of the outbreak. The alert levels, in order of increasing severity, are white, black, amber and red (more detail on these levels can be found in table 2 of the [Defra Generic Contingency Plan for Plant Health in England](#)). Under most scenarios, an outbreak of *R. solanacearum* in a potato field is likely to be given an amber alert status. An amber alert status refers to a serious plant pest/disease with potential for relatively slow but extensive geographical spread leading to host death and/or major economic, environmental or social impacts. However, this could be downgraded to a black alert status (limited geographic spread) depending on the extent of spread.
- 5.11. A factsheet to raise awareness of *R. solanacearum* and its symptoms should be distributed to packers/processors and importers and displayed at public locations, nearby to the infested site and other areas at risk. The factsheet should be distributed to residential addresses nearby to the outbreak site, if it is deemed likely

that hosts of *R. solanacearum* could be growing in residential gardens. Confidential information about the location of the infestation will not be released. The current factsheet along with a guide to irrigating to reduce the risk of *R. solanacearum* can be found on the plant health portal - <https://planthealthportal.defra.gov.uk/pests-and-diseases/pest-and-disease-factsheets/notifiable-diseases/>.

Restrictions on the movement of material, equipment and machinery to and from the place of production

- 5.12. *Ralstonia solanacearum* can be associated with several plant species, although the focus of this plan is on potato crops. Therefore infected, or potentially infected plants or tubers should be restricted from leaving the production site, except when they are being sent for disposal. The material mentioned above may also be moved under exceptional circumstances under notice in consultation with the Defra Risk and Horizon Scanning team, provided there is no identifiable risk of *R. solanacearum* spreading.
- 5.13. *Ralstonia solanacearum* is frequently spread by surface water, which can include processing waste of produce, therefore particular care needs to be taken into identifying potential movement pathways in contaminated water. On suspicion of presence of *R. solanacearum* in a watercourse, the use of surface water for irrigation or spraying of host plants should be prohibited. The movement of material, storage containers, equipment, vehicles and machinery should also be restricted to prevent the movement of the bacterium to non-infected areas. However, if movement is necessary, the material, equipment, vehicles and machinery should be thoroughly cleansed and disinfected at the designated outbreak site to eliminate the bacterium as in points 5.56 – 5.58, again with a particular focus on any wastewater produced.
- 5.14. Movement of personnel into the affected field or production site poses a risk of spread, as *R. solanacearum* can be transferred on clothing, footwear and possessions. Personnel should therefore be briefed on the importance of good hygiene practice to reduce the risk of spread, and movement into the affected field or production site should be minimised as best as possible.

General biosecurity advice and advisory measures for growers

- 5.15. To prevent the water borne or mechanical transfer of *R. solanacearum*, hygiene best practice should be followed as below:
- Training staff to identify symptoms of *R. solanacearum*.
 - Using disposable PPE (including overshoes), which will be destroyed after working on a contaminated production site, or which should only be used in

the contaminated area. If disposable overshoes are not practical, footwear should be cleaned and disinfected before leaving the contaminated area. Using disposable gloves that can be destroyed following work on a particular crop, between different areas within a crop, or between plants, or only used in the contaminated area.

- Avoid using the same equipment and machinery for seed and ware potatoes when growing, packing or processing, particularly from different growers, as there is a higher risk of cross-contamination.
- Avoid cutting tubers, as this increases the risk of spreading *R. solanacearum* through potato stocks.
- Take care when handling potatoes, as any damage can act as openings for the bacterium.
- The fewer people entering a particular field or infected area, the less chance of spread of *R. solanacearum*. Only trained staff should be able to access restricted areas, and there should be a sign in/sign out sheet to record movements.
- Wherever possible during work shifts, uninfected areas should be worked in first before finishing in areas that could potentially be infected. There should be no movement between infected crops and those assumed to be uninfected.
- Maintain up-to-date records of cleansing and disinfection, and the location of potato stocks.
- Volunteer host plants and native vegetation may act as reservoirs for *R. solanacearum*. Controlling these plants reduces the chance of the crop becoming infected and reduces survival and persistence in the event of an outbreak. Volunteer plants can be controlled mechanically (e.g. by hoeing, roguing, flame weeding) and chemically (e.g. using plant protection products). Any disposal required should be as in point 5.57.

Preliminary trace forward / trace backward

- 5.16. Information obtained regarding the origins of suspected infected consignments should be used to locate other related and therefore potentially infected consignments. The NPPO of the exporting country should be contacted, and delivery notes requested upon confirmation of *R. solanacearum*. If material which is suspected as infected with *R. solanacearum* presents a risk to another country, the

NPPO of that country should be informed. This process is particularly important for propagation or seed potato stocks.

- 5.17. In addition to tracing investigations relating to consignments, trace forward/back investigations linked to equipment, vehicles and machinery used in the infected field or production site should be carried out.

Confirming a new outbreak

How to survey to determine whether there is an outbreak

- 5.18. Information to be gathered by the PHSI on suspicion of an outbreak of *R. solanacearum*, in accordance with ISPM 6 guidelines for surveillance (<https://www.ippc.int/en/publications/615/>) includes:
- The origin of the host plants and associated pathways.
 - Details of other premises or destinations where the host plants/products have been sent, where *R. solanacearum* may be present.
 - The layout of the premises and surrounding area (in relation to potential demarcated areas), including a map of the fields/cropping/buildings, at risk growers, and details of neighbouring crops, especially any commercial or non-commercial hosts in fields, allotments, gardens or glasshouses.
 - Details of the host variety, growth stage and any other relevant information.
 - Details of all potato stocks on site, particularly identifying any potatoes which are clonally related to a known infected stock or a stock grown on infected premises.
 - Area and level of infection, including a description of symptoms (photos should be taken).
 - The locations where *R. solanacearum* has been detected, including grid references.
 - The date and time the sample was taken, how it was identified and by whom.
 - Current treatments/controls in place e.g. chemical treatments.
 - Details of the movement of people, equipment, machinery etc. to and from the infected area, and the associated premises.
 - Cultural, biosecurity and working practices.

- The name, address, email and telephone number of the person who found the pest and/or its symptoms, and the business owner/person responsible for the infected premise and crops/consignments.

5.19. Due to the nature of *R. solanacearum*, additional investigation may be required of:

- Places/sites of production using common sources of surface water for spraying or irrigation, or flooded, from a source suspected or confirmed to be contaminated.
- The source of water used for such irrigation (river, lake, reservoir, canal etc.).

5.20. This information should be included on the plant disease investigation template.

5.21. Further to information gathering, samples of other potentially infected plants should be taken to confirm the extent of the infection e.g. in associated fields. This initial survey will be used to determine if it is an isolated finding or an established outbreak.

5.22. Finance for the surveys will depend on the individual circumstances of the outbreak, and will be subject to discussion, usually between Defra policy and the PHSI.

5.23. The PHSI carry out annual monitoring of both tubers and watercourses for *R. solanacearum*. The following section refers to sampling on suspicion and in the event of an outbreak.

Tuber sampling

5.24. Potato tuber coring kits can be obtained from the bacteriology laboratory in Fera Science Ltd. by contacting coringkits@fera.co.uk.

5.25. Buffer provided in the kits should be refrigerated prior to use and ice packs should be frozen prior to sending the samples to the laboratory.

5.26. Ensure that samples arrive at the laboratory the day after sampling, ideally by 9am. Inform the laboratory of the number and expected date of arrival of the samples before 5pm the day prior to arrival at the latest.

5.27. To prevent cross-contamination, use a new pair of disposable gloves, a new sterile corer, a new sterile collection tube and a fresh tube of sterile buffer for each sample.

5.28. Do not package any other sample types with latent core or tuber samples for *R. solanacearum* screening, as these samples will not pass through the plant clinic.

5.29. Instructions for taking cores from potato tubers:

- Wear a new pair of disposable gloves for each sample.
- Select samples of 200 tubers randomly from the entire lot to be sampled.
- Attach a sterile stainless-steel corer to the empty 50 ml screw cap tube.
- Remove as much soil as possible from the heel end of each tuber (e.g. using a new disposable cloth, glove or paper towel for each sample) and locate the point of attachment with the stolon.
- Remove cores from the point of attachment of each tuber in the sample and collect in the tube (it is critical each core must contain vascular tissue from the point of attachment). When 200 cores have been collected, their volume should exceed the 30 ml graduation mark.
- Unscrew the corer and replace it in the original transport pot for return with the sample.
- Add buffer to cover the cores, shake and top up to the 45 ml mark leaving an air space at the top of the tube. Discard any unused buffer or return to the lab within the coring kit for disposal.
- Replace cap and seal tightly.
- Include sample information as needed on the sample tube label, including the sample ID (SID) number, date of coring and the inspector's name.
- Maintain the samples refrigerated or in a cooled box until packaging for sending to the laboratory.
- Always place the cored sample directly against the ice-pack in the transport envelope, also include the used corer, and return overnight to the laboratory using the correct label.
- Where sampling more than 200 tubers (see 5.31), it is important to sub-sample to the maximum 200 core sample. For example, with 4,000 tuber samples, 20 x 200 core sub-samples would be required. A single SID number would be assigned with separate sub-samples identified by letter e. g. 'A', 'B', 'C' etc.
- If several core samples are sent together in an outer bag or box, ensure that the 'Potato cores' label will be visible and easily identifiable upon arrival at the laboratory.
- Collect cored tubers from each sample and store separately in labelled secure bags until results are known.

- 5.30. If the tubers are deemed too difficult to sample in the field, following IMT approval the tubers can be sent to the lab for processing (using the tuber label). As previously, Fera Science Ltd. should be informed prior to arrival at the laboratory. Cores and tubers are sent to different parts of the laboratory.
- 5.31. A higher sampling density may be required during trace-back during outbreaks to give greater confidence in detecting an infection of *R. solanacearum*. In practice, 20 x 200 tubers (4,000 tubers in total) are sampled from each suspicious lot. See ISPM 31 for details (<https://www.ippc.int/en/publications/588/>).

Water Sampling

- 5.32. Instructions for taking water samples:
- In both flowing and non-flowing water bodies samples should be taken near host plants (e.g. *Solanum dulcamara*) if present.
 - For rivers, water should be collected from flowing water, not stagnant water, and using a sterile water bottle.
 - Collection can be achieved by throwing the bottle attached to a weighted soil basket in on a rope or telescopic rod. Ideally water samples should be 500 ml and collected from the middle of the watercourse if no host plants are identified, and from a depth of approximately 30 cm. If a bucket is used to collect a larger sample, then disinfection should be carried out between sampling points. A label should be attached to the sample bottle detailing the sample ID, inspector, sampling date, sampling point description, grid reference and water temperature.
 - Samples are to be sent to Fera Science Ltd. using guaranteed next day delivery. It is preferable for samples to arrive before 12 noon the day following sampling. Any samples arriving more than 24 hours after sampling will not be tested as results would be unreliable.

Diagnostic procedures

- 5.33. Identification of *R. solanacearum* is carried out in line with [Commission Implementing Regulation \(EU\) 2022/1193](#) (EU 2022) and following additional guidelines given in the EPPO Diagnostic Protocol PM7/21 (3) (EPPO 2022).
- 5.34. At Fera Science Ltd., screening is routinely carried out by plating on semi-selective mSMSA medium. Where colonies with typical morphology are isolated, two identification tests are utilised to confirm detection and identification. Two TaqMan real-time PCR assays are routinely utilised for identification. The first of which uses

real-time PCR primers and probes RS-I-F, RS-II-R and RSP-55T which target specific 16S rRNA gene sequences conserved within all members of the *R. solanacearum* species complex. This provides a first indication of whether the isolate is a member of the *R. solanacearum* species complex. If the first test is positive then a second assay uses real-time PCR primers and probes B2-I-F, B2-II-R and B2-P which target specific prophage sequence specific to strains of *R. solanacearum* Phylotype IIB-1 (race 3, biovar 2). These two sets of primers target two different parts of the genome as recommended in PM7/21 (3). If both assays provide positive results, the isolate is identified as *R. solanacearum*. If the RS assay provides a positive result and the B2 assay a negative result, then a phylotyping PCR is carried out to determine species.

It is possible to utilise the RS TaqMan assay described above as an initial rapid screening test of symptomatic material or processed asymptomatic samples. This approach may be taken where initial results are under significant time pressure. A positive result would provide a first indication that a member of the RSSC was detected. Isolation would then be attempted to allow identification and confirmation of pathogenicity.

- 5.35. A pure culture of the isolate can be subjected to additional identification tests which could include matrix-assisted laser desorption/ionization time of flight mass spectrometry (MALDI-TOF), Fatty Acid Profile analysis or DNA barcoding. As these analyses require a pure culture, results will take 5 to 10 days.
- 5.36. In EPPO's diagnostic protocol it is also recommended that a pathogenicity test is performed in critical cases. The definition of critical cases are described in PM 7/76 (6) Use of EPPO Diagnostic Standards where additional confidence in the outcome of the diagnosis will be required (EPPO 2024a). These are when i) detection of a pest in an area where it is not known to occur, ii) cases where a pest is identified by a laboratory for the first time and iii) detection of a pest in a consignment originating in a country where the pest is declared to be absent. Pathogenicity tests can be performed by Fera Science Ltd. using a host plant species (for example: *Solanum lycopersicum*) and can confirm pathogenicity of the isolate if Koch's postulates are met by re-isolating *R. solanacearum* from test plants which are displaying wilt and flaccidity symptoms.
- 5.37. It is recommended that the variety of the potatoes be confirmed by DNA fingerprinting analysis at SASA.

Criteria for determining an outbreak

- 5.38. If *R. solanacearum* is detected at a location other than at a port or confined to a particular consignment or watercourse with no risk of spread, then an outbreak

should be declared. For example, if it is identified in a potato field, then this would be classified as an outbreak. However, if it is restricted to recently imported potatoes or tomatoes within a cold store then this would be classified as an interception. If only symptoms are found, then the outbreak should be treated as suspected until it is confirmed by testing.

Official action to be taken following the confirmation of an outbreak

5.39. The scale of the outbreak will determine the size and nature of the IMT and action.

Communication

5.40. The IMT (and LGD as appropriate) will assess the risks and communicate details to the IPPC and EPPO, in accordance with ISPM 17: pest reporting (<https://www.ippc.int/en/publications/606/>), as well as to Defra Ministers, senior officials, devolved governments, and other government departments and agencies (e.g., the Environment Agency) on a regular basis as appropriate; and to stakeholders. This process will be coordinated by the Defra International Plant Health Policy team.

5.41. If there is a risk of contamination of potatoes coming from, moving into another country or moving internally within the UK, the country should be informed of the relevant details.

5.42. A generic communications plan is available for use across all plant health outbreaks. This is owned by APHA and FC communications teams and is intended to provide consistency across outbreaks. This plan can be tailored to the outbreak, using pest and outbreak specific information. It includes a list of key stakeholders and templates for:

- Core narratives
- Press releases
- Reactive lines
- Frequently asked questions

Surveillance and demarcated zones

5.43. In line with section 3 of EPPO Standard PM 9/3 (3) ([EPPO Standards on national regulatory control systems](#)) (EPPO 2023), designate as **infested** the tubers or plants, consignment and/or lot, the waste (e.g. soil, processing waste) from the

infested lot, and the machinery, vehicle, vessel, store, watercourses or units thereof, and any other objects including packaging material, from which the sample was taken, and, where appropriate, the place(s) of production and field(s) from which the lot was grown. This is akin to the **infested zone** in the generic contingency plan.

5.44. In line with section 3 of EPPO Standard PM 9/3 (3) (EPPO 2023), designate the extent of **probable infestation** as the following, which is akin to the **buffer zone** in the generic contingency plan:

- Tubers or plants grown at a place of production designated as infested.
- Places of production with some production link to the tubers or plants designated as infested, including those sharing production equipment, irrigation water and facilities directly or through a common contractor.
- Tubers or plants produced in the place(s) of production referred to in the previous bullet point, or present in such place(s) of production during the period when the tubers or plants designated as infested were present on the place of production referred to in the first bullet point.
- Premises handling potatoes from the places of production referred to in the previous bullet points.
- Any machinery, vehicle, vessel, store, or units thereof, and any other objects including packaging material, that may have come into contact with the tubers or plants designated as infested.
- Any tubers or plants stored in, or in contact with, any of the structures or objects listed in the previous bullet point, prior to the cleansing and disinfection of such structures and objects.
- Those tubers or plants with a sister or parental clonal relationship to the tubers or plants designated to be infested and for which, although they may have tested negative for the organism, it appears that infestation is probable through a clonal link. Variety testing may be undertaken to verify the identity of the infested and clonally related tubers or plants.
- Places of production of the tubers or plants referred to in the previous bullet point.
- Places of production which share the same surface water, due to flooding or use of water due to irrigation and spraying. This could include neighbouring fields.

- 5.45. In line with section 3 of EPPO Standard PM 9/3 (3) (EPPO 2023), a demarcated area should be established based on the designation of infestation (point 5.43), the designation of probable infestation (point 5.44), and the possible spread of the organism based on the proximity of other places of production growing potatoes or other host plants, the common production and use of seed potato stocks and shared surface water sources.
- 5.46. Initial maps of outbreak sites should be produced by members of the plant health service.
- 5.47. In line with section 3 of EPPO Standard PM 9/3 (3) (EPPO 2023), testing must be carried out on potato stocks which are clonally related to those involved in the infestation, or of the same source, to determine the probable primary source of infection, and testing must be carried out to determine the extent of probable infestation, preferably in order of degree of risk. This will include places of production that are in proximity to infested and probably infested premises.
- 5.48. When establishing a sampling strategy for a reported outbreak, it should be designed in such a way that it is not necessary to return to previously sampled lots or fields.
- 5.49. When sampling those lots with a high suspicion of being infected with *R. solanacearum* such as for clonally related stock a high rate of sampling should be applied (e.g. 200 tubers per 5 tonnes). At the place of production where the outbreak has been reported, the remaining lots which have no direct suspicion should be sampled at a lower rate (e.g. 200 tubers per 25 tonnes). If *R. solanacearum* is detected at the end or during the sorting process identifying crates where the infected lot is stored may not be possible. In this situation sampling is recommended at 200 tubers per crate/tonnes (EPPO 2023). Sampling rates can be adjusted depending on the situation in consultation with the IMT.
- 5.50. The demarcated area should be adjusted in response to further findings.

Pest management procedures

- 5.51. The primary means of spread of *R. solanacearum* is by contaminated water, therefore every effort should be made to minimise the production of contaminated water when an outbreak is confirmed.
- 5.52. Host plants should not be moved off site unless for destruction, unless prior agreement by the IMT.
- 5.53. Any tubers or potato plants designated as infested should be disposed of by approved means as in point 5.57. If there are potato plants still being grown in fields designated as infested, the plants should be destroyed. If tubers have not

developed, the plants should either be cut and ploughed into the soil or treated with an approved herbicide/desiccant as in point 5.56. If progeny tubers have developed, a plant growth regulator could be applied to reduce viability of tubers, then these should be harvested and disposed of appropriately. If the planted potato crop has not emerged it could still be harvested and disposed of in line with point 5.57. All the equipment and machinery used to harvest or plough the crop must be cleansed and disinfected as in point 5.58.

- 5.54. Any other tubers or plants designated as probably infested must not be planted and should be disposed of using one of the options outlined in point 5.57. Alternatively:
- Under the recommendations of the Defra Risk and Horizon Scanning Team, tubers may be used as ware, provided they are packed for direct delivery and use without repacking. Any waste produced should be treated appropriately.
 - Composting on farm at the place of production under official supervision to ensure all material is composted by exposure of at least 55°C for an uninterrupted period of two weeks and returned to the production site.
 - Anaerobic digestion for production of bio-gas at an officially approved site may also be a suitable method for disposal. However, the process needs to be validated before it is used as a phytosanitary control treatment. A suggested treatment is to subject the entire volume of material in a thermophilic digester, to a minimum temperature of 55°C, maintained over a period of 24h without interruption with a hydraulic dwell time in the reactor of at least 20 days.
- 5.55. Any machinery, vehicle, vessel, store, or units thereof, and any other objects including packaging material, designated as infested or probably infested must either be destroyed as in point 5.57 or cleansed and disinfected as in point 5.58.

Disposal plan

Infected plant material

- 5.56. The primary means of destruction of potato plants in a field is through herbicide application. The Defra Risk and Horizon Scanning team will advise on possible treatments.
- Prior to any herbicide being used, the risk posed by the herbicide to people and the environment will be assessed.
 - Any applications should be made following the advice on the product label and be in accordance with HSE guidance. In some cases, there may be a requirement to carry out a Local Environment Risk Assessment for

Pesticides (LERAP) depending on the product used and the situation of the finding.

- Growers will be placed under notice to apply the recommended herbicides and make the applications using their own or contractor's equipment. Records of applications will be kept, including details of the amount of product and water used.

Infected tubers/soil/plant debris/washings

5.57. Disposal and/or destruction should be under the approval and supervision of the PHSI. If the material must be moved off the premises, it should be contained within at least one sealed layer, and two layers if possible, and should not be split open prior to being buried or incinerated. The vehicle used for transport must be cleaned and disinfected after use. The following disposal methods are approved for *R. solanacearum*-infected material:

- **Deep burial** (minimum 2 m with immediate backfill), which can be done at an approved landfill site, or on the site or nearby farm, but only in agreement with the local Environment Agency, who is satisfied that there will be no risk of contaminating ground water.
- **Incineration**, which must comply with appropriate waste management regulations laid out by the Environment Agency in England.
- **Use as animal feed** following steaming / boiling for at least 30 minutes.
- **Approved commercial composting** according to PM 3/66 (EPPO 2022a). Waste should be composted in such a way that run-off is controlled. The resulting compost should not be used on arable land. It can be returned to non-agricultural land, permanent wooded areas, grassland or pastures, as well as land which is not, and will not be used for arable crop production, such as orchards, Christmas tree production sites or short rotational plantations (e.g. fast-growing trees for biomass production).
- **Direct and immediate delivery for industrial processing** to a site which operates officially approved waste disposal facilities, and which has a system of disinfection of storage areas and departing vehicles.
- Treatment of liquid washing or drainage effluent will be decided on a case-by-case basis but will likely include an **approved treatment to remove all solids, followed by a treatment to kill the bacteria, such as heat or UV treatment**. EPPO Standard PM 9/3 (3) (EPPO 2023) recommends that liquid waste should be heated to a minimum of 60°C throughout the entire volume consistently, for

at least 30 minutes prior to disposal. Solid waste should be disposed of by deep burial or incineration as above.

- 5.58. All objects designated as 'infested' or 'probably infested', such as equipment, vehicles, machinery, boxes and storage facilities, should be thoroughly cleansed and disinfected to eliminate the risk of spread of *R. solanacearum*. This should be carried out at the outbreak site or a site nearby in agreement with a Plant Health and Seeds Inspector. Any waste material generated, including liquid waste, should be disposed of as in 5.57.

Measures in subsequent seasons

Infested fields

- 5.59. Measures for infested places of production:

- All objects which have or may have been in contact with either infested or probably infested material should be treated in line with the EPPO standard PM 10/1 (1) ([PM10 - Phytosanitary Treatments|EPPO Global Database](#)) describing cleaning and disinfection procedures in potato production (EPPO 2006).
- This cleaning and disinfection process should occur in the year of infection and also after the first subsequent growing year.
- Due to the importance of volunteer and natural hosts in the persistence of *R. solanacearum*, these should be eliminated from all sites of the place of production in line with the EPPO standard PM 3/89 (1) ([PM3 - Phytosanitary procedures|EPPO Global Database](#)) on controlling potato plant volunteers (EPPO 2020) for both scenarios in 5.60.

- 5.60. Measures for infested production sites must follow I or II:

- I. For the next four years from the start of the next growing season, growers must eliminate volunteer potato plants and other naturally found host plants (see point 5.57 for guidance on destruction). In addition, no potato tubers, plants, true seed, or other naturally found host plants of the organism or crops for which there is an identified risk of the organism spreading, shall be planted.
 - When a potato crop is grown for the first time these should be tested for *R. solanacearum* at an appropriate growth stage.
 - When potatoes are produced for the first time following infestation and the above point met, only ware potatoes should be produced, and once harvested these should be tested by Fera Science Ltd (5.24-5.31).

- When the second crop of potatoes are grown in the rotation following the infestation, either seed or ware potatoes may be produced and a survey conducted.
 - The production of ware from certified seed can be conducted after an appropriate rotation (preferably at least two years)
 - To produce certified seed there must be at least four years immediately preceding the planting of the seed crop with no potatoes grown, this would be the 10th year following the outbreak.
- II. For the next three years from the start of the next growing season, the production site must be maintained either in bare fallow, used for cereals or under permanent pasture with frequent close cutting or intensive grazing, or as grass for seed production. However, if the site is at particularly high risk of diffuse pollution running into water courses alternatives will be considered to adhere to The Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018.
- Following this period and if the field has been found free from volunteer potato plants and other naturally found host plants during official inspections for at least two consecutive years prior to planting, either ware or seed potatoes may be grown, but harvested tubers must be tested for *R. solanacearum*.

Measures for other production sites (initially designated as probably infested)

- 5.61. If investigations have demonstrated that the source of infection at the infested premises was not by contact with other tuber lots, but clonally or by irrigation with contaminated water courses. The first potato crop must be from certified seed potatoes which are planted for ware where no potatoes or other cultivated solanaceous hosts have been grown for at least two years previously. The PHSI should inspect the growing crop, and any volunteer plants should be tested for infection. Harvested tubers must be inspected and tested for *R. solanacearum* (at a suggested rate of 200 tubers per 25 tonnes, the lower rate from 5.49).
- 5.62. If investigations have demonstrated that the source of infection was not clonal or by irrigation, but by contact with other tuber lots in the first year, either no host plants of *R. solanacearum* should be planted or only ware potatoes produced from certified seed potatoes. In the second and third year following confirmation of *R. solanacearum*, certified seed potatoes may be grown for seed production as well as ware production. To produce certified seed there must be at least four years immediately preceding the planting of the seed crop with no potatoes grown. Measures must be taken to eliminate any volunteer potato plants and other naturally found host plants of *R. solanacearum*, and harvested tubers must be tested for the bacterium for three consecutive years.

- 5.63. Alternatively, in the second and third year, potatoes grown under official control and tested for *R. solanacearum* may be planted instead of certified seed potatoes. In the third year, potatoes grown under official control from certified seed potatoes may also be planted instead of certified seed potatoes.

Further measures applied to the whole regulated area (infested and probably infested places of production)

In the first year of infection:

- 5.64. All machinery, equipment and storage facilities involved with potato production must be cleansed and disinfected, as in point 5.58.

For three years, or as long as the infested production sites are subject to the above requirements:

- 5.65. Any premises growing, storing or handling potatoes/tomatoes (including those of contractors) will be supervised and controlled under notice.
- 5.66. Growers must plant only officially certified seed potatoes, or seed potatoes once-grown under official control, for all potato production. Seed potato crops grown in places of production designated as probably infested must be tested at harvest.
- 5.67. Ware potatoes and seed potatoes must be handled separately on all premises within the demarcated area, or there must be a system of cleansing and disinfection in place between the handling of ware and seed potato stocks.
- 5.68. Harvested seed potato crops on probably infested places of production should be tested for *R. solanacearum*.
- 5.69. An annual official survey will be carried out. The official survey will include visual inspection of plants and tubers, and sampling of tubers for testing (as in points 5.23-5.35).
- 5.70. A programme should be established to replace all seed potato stocks over an appropriate period of time.

Measures for regulated surface water

- 5.71. Regulated surface water should not be used for irrigation or spraying host crops, unless appropriately treated as in 2.2.
- 5.72. If a complete watercourse is regulated and likely to remain so due to the presence of natural hosts, no further testing for *R. solanacearum* is necessary. In all other situations, samples of surface water should be taken and tested within and around

the regulated areas at appropriate times according to the EPPO standard PM 7/21 (3) (EPPO 2022).

- 5.73. Where appropriate, in the area around the water course, all potato and tomato crops should be inspected, and seed potatoes tested.
- 5.74. Samples of *S. dulcamara*, *S. nigrum*, *Urtica dioica* or *U. urens* may also be tested.
- 5.75. Following the results of inspections and tests the regulated areas should be updated accordingly.
- 5.76. When host crops may have been in contact with contaminated surface water, these should be designated as probably infested.

6. Criteria for declaring eradication / change of policy

- 6.1. *Ralstonia solanacearum* can be declared eradicated (by the Chief Plant Health Officer) in potato after:
 - I. At least seven years if the infested field(s) is not left in bare fallow or permanent pasture (as above). No host plants should be grown for four years. There must be at least two consecutive years within this four-year period without volunteer potato plants or naturally found host plants prior to planting of certified seed for ware potatoes. Following a rotation of ideally two years prior to planting certified seed for ware and at least five years for production of certified seed prior to planting the second potato crop. Once harvested, and tubers test negative for *R. solanacearum*, eradication may be declared.
 - II. At least six years if the infested field(s) is left in bare fallow, used for cereals, or under permanent pasture with frequent close cutting or intensive grazing, or as grass for seed production for three years. This is followed by two successive years with planting non-hosts which have no identified risk of the pest surviving. Once ware or seed potatoes planted after this are harvested and test negative for *R. solanacearum* eradication may be declared.

7. Evaluation and review of the contingency plan

- 7.1. This pest specific contingency plan should be reviewed regularly to consider changes in legislation, control procedures, pesticides, sampling and diagnosis methods, and any other relevant amendments.
- 7.2. Lessons should be identified during and after any outbreak, including what went well and what did not. These should be included in any review of the contingency plan leading to continuous improvement of the plan and response to outbreaks.

8. Appendix A

Datasheet for *Ralstonia solanacearum*

Identity

PREFERRED SCIENTIFIC NAME	AUTHOR (taxonomic authority)
<i>Ralstonia solanacearum</i>	(Smith 1896) Yabuuchi <i>et al.</i> 1996 emend. Safni <i>et al.</i> (2014)

CLASS: Betaproteobacteria

ORDER: Burkholderiales

FAMILY: Burkholderiaceae

GENUS: *Ralstonia*

SPECIES: *Ralstonia solanacearum*

SYNONYMS

Pseudomonas solanacearum

Bacterium solanacearum

Burkholderia solanacearum

COMMON NAMES

Brown rot of potato

Bacterial wilt of tomato

Moko disease of banana

Notes on taxonomy and nomenclature

Ralstonia solanacearum is a motile, Gram-negative bacterium with a complex taxonomic history. This species was originally named *Bacillus solanacearum*, later renamed as *Burkholderia solanacearum* and subsequently assigned to a new genus *Ralstonia* (Yabuuchi *et al.*, 1995). Earlier subdivisions of the species were based on differences in host range (races), differences in biochemical and phage reaction (biovars) and phylogenetics (Phylotypes) (EFSA 2019b). These subdivisions were described under the broad term *Ralstonia solanacearum* species complex (RSSC) containing four phylotypes (Fegan & Prior 2005). In 2014 Safni *et al.* placed the four phylotypes into three distinct species: *R. solanacearum* (Phylotype II), *R. pseudosolanacearum* (Phylotypes I and III) and *R. syzygii* (Phylotype IV). This datasheet applies to *R. solanacearum sensu stricto*

(previously Phylotype II and particularly Phylotype IIB, sequevar I (IIB-I), formerly known as race 3, biovar 2).

Biology and ecology

Lifecycle

Ralstonia solanacearum can enter the host plant through natural openings (stomata) or through root and stem wounds, which have either been created naturally (excision of leaves or root emergence) or by mechanical and feeding damage. Once inside the plant, the bacterium moves within the vascular system and colonises the xylem resulting in blockage of the xylem vessels which disrupts the transport of water producing wilt associated symptoms and in severe cases plant death. Over the winter, the bacterium survives within plant debris, tubers left in the field and in other hosts such as the perennial plant *Solanum dulcamara* (bittersweet or woody nightshade) serving as a source of inoculum for the next cycle (EFSA 2019a).

Ralstonia solanacearum is closely associated with living host plants and host-plant debris, however, *R. solanacearum* can persist for limited periods of time in soil and water. In soil, the bacterium has a survival time of around 200 days depending on biotic factors. In temperate conditions soil borne inoculum does not seem to play a role in the overwintering of the bacterium (EFSA 2019a). In water, bacterium's survival depends on physical and biotic factors and can vary from several years in sterile water to less than a month in ditch water. *Ralstonia solanacearum* can persist for prolonged periods of time in surface water where host plants such as *S. dulcamara* grow along the water banks with roots trailing in the water leaching bacterial cells into the watercourses. The presence of perennial host plants can act as a reservoir for the bacterium, playing an important role in the survival and establishment of the pathogen (EFSA 2019b).

The information on survival of the bacterium on the surfaces of tools or containers is limited and highly variable. Studies have reported *R. solanacearum* surviving for 5 hours on wood, 17 days on metal and more than 87 days on rubber (Wenneker *et al.*, 1998).

Modes of transmission

1. **Vegetative propagation material** including infected **seed potatoes** and ornamental species are the main pathways for long distance spread. *Ralstonia solanacearum* infection can often be latent, especially at low temperatures and in tolerant varieties, this can contribute to the unintentional spread of the bacterium.

2. **Imported ware potatoes** and other products.

3. **Infected potato waste** can occur when infected potatoes are cleaned and processed by industry and untreated contaminated waste is discharged into watercourses (EFSA 2019a).

4. **Contaminated water.** Surface water can also become contaminated where wild host plants such as *S. nigrum* and *S. dulcamara* are present along the banks of waterways. The use of contaminated water for irrigation or spraying can spread the bacterium into new crops and is considered the source of many outbreaks of potato brown rot in Europe (EPPO 2024b).

5. **Infected volunteer plants** can be a source of inoculum for subsequent crops and infect healthy plants.

6. **Soil.** As with other soilborne bacteria, infection can also occur by movement of infected soil and growing media.

7. **True seed.** Although there have been cases of contaminated seed of tomato and Capsicum, there is no evidence of seed infection and transmission (EPPO 2024b).

Hosts/crops affected

Ralstonia solanacearum is known to infect a wide range of cultivated and wild hosts. Major hosts of economic importance in the UK are, *Solanum tuberosum* (potato), *S. lycopersicum* (tomato), *S. melongena* (aubergine) and *Capsicum annuum* (sweet pepper). Other major hosts of global economic significance include *Musa* crops (banana and plantain), *Nicotiana tabacum* (tobacco) and *Arachis hypogaea* (peanut) (EPPO 2024b).

This pathogen is also known to infect solanaceous weeds including *S. nigrum* (black nightshade) and *S. dulcamara* (bittersweet or woody nightshade) which are the main alternative hosts of the pathogen, and other weeds such as *Urtica urens* (small nettle), *U. dioica* (common nettle) and *Senecio vulgaris* (groundsel). There are also several ornamental hosts grown in the UK including *Pelargonium zonale*.

Historical reports of plant hosts have not always distinguished between different races, biovar, phylotypes or species, for example CABI provides a comprehensive host list but it does not identify the pathogen at the phylotype or species level (CABI 2022).

The host list for *R. solanacearum* (RSSC phylotype II) reported here has been collected from EPPO (2024b).

Anthurium, *Arachis hypogaea*, *Bidens mitis*, *Bidens pilosa*, *Canna indica*, *Capsicum annuum*, *Capsicum pubescens*, *Casuarina equisetifolia*, *Chenopodium album*, *Cichorium intybus*, *Citrullus lanatus*, *Cleome viscosa*, *Coleus amboinicus*, *Cucumis melo*, *Cucumis sativus*, *Cucurbita maxima*, *Cucurbita pepo*, *Datura stramonium*, *Eleusine indica*, *Emilia sonchifolia*, *Epipremnum pinnatum*, *Eucalyptus*, *Eupatorium cannabinum*, *Galinsoga*

parviflora, *G. quadriradiata*, *Gliricidia sepium*, *Heliconia*, *Hydrangea macrophylla*, *H. paniculata*, *Hydrangea* sp., *Hydrocotyle ranunculoides*, *Impatiens*, *Ipomoea hildebrandtii*, *Marsypianthes chamaedrys*, *Musa* sp., *Musa x paradisiaca*, *Nicotiana tabacum*, *Oxalis* sp., *Pandanus* sp., *Pelargonium x hortorum*, *Pelargonium*, *Peperomia pellucida*, *Persicaria capitata*, *P. pensylvanica*, *Phaseolus vulgaris*, *Physalis angulata*, *Piper dilatatum*, *Piper hispidum*, *Polygonum arenastrum*, *Portulaca oleracea*, *Psidium guajava*, *Salpiglossis sinuata*, *Senecio vulgaris*, *Sesbania*, *Solanum aethiopicum*, *S. americanum*, *S. betaceum*, *S. carolinense*, *S. cinereum*, *S. dulcamara*, *S. lycopersicum*, *S. melongena*, *S. nigrum*, *S. pseudocapsicum*, *S. sarrachoides*, *S. scabrum*, *S. tuberosum*, *S. villosum* subsp. *miniatum*, *S. villosum*, *Soliva anthemifolia*, *Tagetes*, *Urtica urens*, *Vaccinium corymbosum*, *Vaccinium* hybrids, *Xanthosoma* sp.

Plant stages affected

Flowering, fruiting, vegetative and post-harvest stages are all affected.

Plant parts affected

Tubers, leaves, roots, seedlings, stems and accompanying soil are all affected.

Symptoms/signs - description

Symptom expression occurs at different rates in different varieties and is favoured by warm temperatures (above 15 °C with optimum around 25°C) and other environmental conditions (especially high soil moisture). In some cases, the bacteria can latently infect tubers without causing noticeable symptoms and can survive in seed tubers during storage causing disease when planted the next season.

Potato

The first visible symptoms of infection occur on the foliage of the plant with the wilting of leaves and shoots during the warmest part of the day, although plants may recover at night. In cool climates plants may not manifest foliar symptoms at all (EFSA 2019a). As the disease develops, stems can show streaky brown discolorations, and leaves may have a bronze tint. Eventually, plants can fail to recover resulting in necrosis and plant mortality. When stems are cut, brown discoloration of the vascular system and bacterial ooze can often be observed (EFSA 2019a).

External symptoms on potato tubers may not be visible, depending on the level of infection and state of development of the disease. Symptoms are more likely to be observed in the vascular tissue when infected tubers are cut. The initial symptom is brown staining of the vascular ring which starts from the stolon and progresses through the vascular tissue. A

few minutes after cutting a creamy bacterial exudate may appear spontaneously on the vascular ring or when the cut tuber is squeezed. As disease develops bacterial ooze may emerge from the eyes and stolon end of infected tubers. Soil may adhere to the tubers when this bacterial exudate dries, giving tubers a dirty appearance.

Tomato

The first symptom of the bacterial infection in tomato plants is the wilting of the youngest leaves, usually during the warmest time of the day. Under favorable conditions for the pathogen, rapid wilting of the whole plant may follow. Under less favorable conditions, the disease progression is slower, stunting can occur and a proliferation of roots from the stem may occur (adventitious roots). When stems are cut, the vascular tissues of the stem show a brown discoloration and a drop of white or pale creamy bacterial ooze may be released.

Similarities to other species/diseases/plant damages

Wilting symptoms of brown rot (*R. solanacearum*) may be confused with other wilting pathogens on potato such as ring rot (*Clavibacter sepedonicus*), dry rot (*Fusarium* spp.), wilt (*Verticillium* spp.), and blackleg (*Dickeya* / *Pectobacterium* & *Dickeya* spp.) (EPPO 2022). Brown rot usually develops earlier and more rapidly than ring rot. For ring rot bacterial slime does not exude spontaneously and the tuber needs to be pressed for a mass of whitish-yellow decayed vascular tissue to emerge.

Symptoms of bacterial wilt in tomato may be confused with those of bacterial canker (*Clavibacter michiganensis*) which can show necrotic windowing on leaves and yellow to brown vascular discoloration (EPPO 2022).

Detection and inspection methods

The EPPO Standard on Diagnostics PM 7/21 (3) provides guidance on sampling, screening and identification testing for symptomatic and asymptomatic plant samples and water samples (EPPO 2022).

For field diagnosis from symptomatic tissues, a rapid presumptive test for the RSSC can be performed by observation of bacteria streaming from the cut surface of a stem suspended in water and which can be followed by lateral flow serological tests (EPPO 2022).

Official laboratory testing in line with PM 7/21 (3) includes screening tests (isolation on selective media, immunofluorescence (IF) and molecular tests (LAMP, conventional and Real-time PCRs) and identification tests (IF, Molecular tests, DNA barcoding and Matrix-assisted laser desorption/ionization time of flight mass spectrometry (MALDI-TOF)).

Additional information regarding diagnostics can be found on the Standards [PM 7/21 \(3\)](#) including a flow diagram describing the diagnostic procedures.

Distribution

History of introduction/spread

R. solanacearum (phylotype II) originates in Central and South America and has spread around the world with the international movement of infected potato tubers and *Pelargonium* cuttings (EPPO 2025b). It is now present in many countries in the EPPO region (Figure 2), and it has established in wild plants along watercourses, continually reinfesting these water sources which makes eradication difficult.

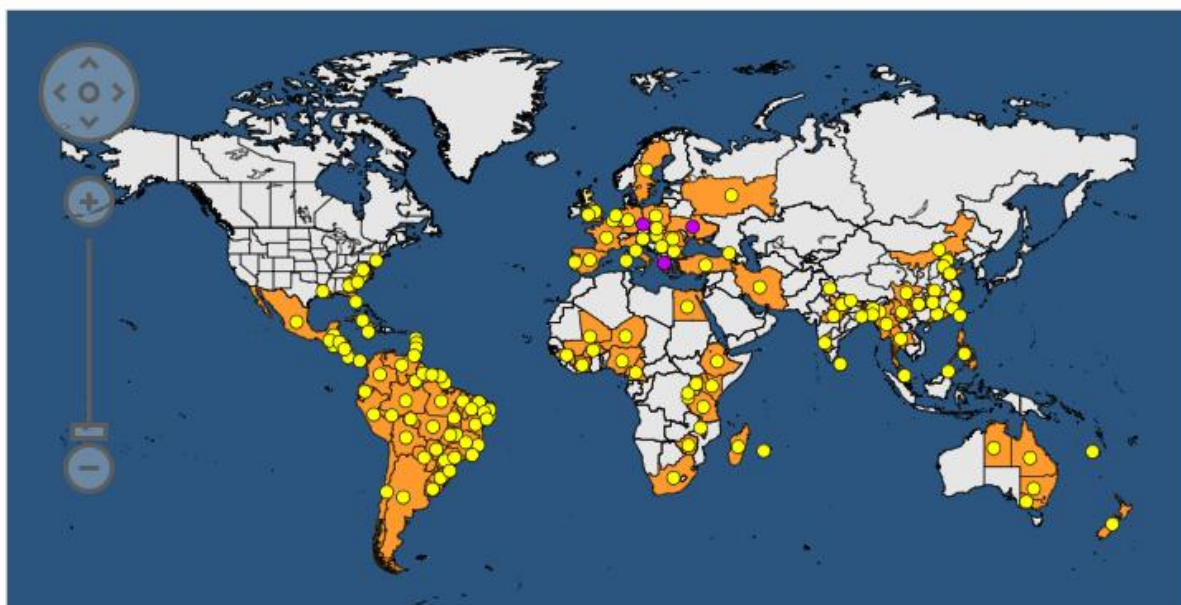


Figure 2. Global Distribution of *Ralstonia solanacearum* (EPPO 2025c).

Phytosanitary status

Ralstonia solanacearum is a GB Quarantine Pest (Annex 2 Part B) in the assimilated Phytosanitary Conditions Regulations (EU) 2019/2072 and is therefore prohibited from being introduced into or spread within GB. It is also on the EPPO A2 list and is therefore recommended for regulation by EPPO member countries. A full table of country and regional categorisation is provided (Table 1).

Table 1. Global categorisations of *Ralstonia solanacearum* (adapted from EPPO (2025c))

Country / Region	List	Year of addition
Africa		
Guinea	A1 List	2022
Morocco	Quarantine pest	2018
Tunisia	Quarantine pest	2012
America		
Argentina	A2 list	2019
Brazil	A2 list	2018
Chile	A2 list	2019
Asia		
China	Quarantine pest	2021
Iran	A1 list	2018
Europe		
Azerbaijan	A1 list	2024
Georgia	A2 list	2018
Serbia	A1 list	2015
Switzerland	A1 list	2019
Ukraine	A1 list	2019
United Kingdom	A2 list	2020
RPPO / EU		
EPPO	A2 list	2017
EU	A2 Quarantine pest (Annex II B)	2019

Ralstonia pseudosolanacearum and *R. syzygii* (as *R. syzygii* subsp. *celebesensis* and *R. syzygii* subsp. *indonesiensis*) are also listed as GB Quarantine Pests in Annex 2 Part A of 2019/2072.

Means of movement into the UK

The most likely method of dispersing *R. solanacearum* into the UK is through the international movement of infected vegetative propagating material of host plants, mainly seed potatoes. In England the majority of outbreak have been a result of using contaminated irrigation water.

Another pathway for entry is through importing infected ware potatoes for consumption or for industrial processing. The bacterium can be introduced into the agricultural system when waste produced during washing and processing of potatoes is discharged into watercourses and this water is used to irrigate susceptible crops.

Control

Currently there are no effective biological or chemical control methods for *R. solanacearum*, and breeding for resistant varieties of tomatoes or potatoes has been largely unsuccessful. There is therefore a reliance on starting with clean planting material, crop hygiene, monitoring and rotations.

Some resistant varieties of tomatoes have been reported however resistance is suggested to be strain specific and often varieties lose desirable agronomic and commercial properties. Breeding of tolerant varieties shouldn't be encouraged as they can shelter virulent bacteria and act as reservoirs of the disease (Huet 2014). The most effective control is through using pathogen-free planting material and irrigation water along with effective crop surveillance and monitoring for symptoms to protect areas which are free from the bacteria. For potatoes, obtaining disease free material using certification schemes, and post-harvest testing of seed potatoes is also recommended (EPPO 2025c). For tomato, in addition to planting tested material free of the bacteria, production systems disinfection of the recirculating water in hydroponics or irrigation systems in greenhouses can prevent the spread of any introduced bacteria.

Appropriate sanitation procedures are also important for minimising introduction and spread of the disease including:

- Regularly clean and disinfect machinery, equipment, containers, vehicles and storage facilities used during potato production.
- Avoid sharing machinery, equipment, containers and vehicle where possible to avoid the spread of the disease by contact.
- Avoid surface water for irrigation.
- Avoid planting ware potatoes, plant only certified potato seed (Yuliar *et al.*, 2015).
- Avoid cutting seed potatoes (CABI 2022).
- Control of weed hosts and volunteer plants.
- Implement crop rotation without susceptible crops (CABI 2022, Wang *et al.*, 2023).

Impact

Ralstonia solanacearum is one of the world's most important plant pathogenic bacteria due to its extensive distribution, wide host range including economically important species, disease severity, genome plasticity and eradication difficulty.

Ralstonia solanacearum, is on the UK Strategic Export Control List (Department for Business & Trade 2025) and listed as a Select Agent plant pathogen under the USA Agricultural Bioterrorism Act of 2002 (EFSA 2019b). Potato crop losses of 90 and 100%

have been reported from Bangladesh and China respectively (Jiang *et al.*, 2017, Karim *et al.*, 2018). Historically, heavy losses were reported on potato in Portugal (Cruz *et al.*, 2012). In addition to direct yield losses, economic losses are also incurred through reduced marketability of the crop, disposal of infected seed material and replacement of seed material, loss of certification status, increased surveillance, statutory eradication measures and restrictions on further production on contaminated land.

9. References

- Allen D & Lindley-Klassen D** (2023) Plant Pest Factsheet: Brown Rot *Ralstonia solanacearum*. Defra.
- Blom NI, Gorkink-Smits PPMA, Landman NM, van de Bilt JLJ, Vogelaar MAW, Raaymakers TM, Visser M, Pel MJC & Bergsma-Vlami M** (2024) *Ralstonia solanacearum* (phylotype II) isolated from Rosa spp. in the Netherlands is closely related to phylotype II isolates from other sources in the Netherlands and is virulent on potato. *European Journal of Plant Pathology* **171**, 445-458.
- CABI** (2022) *Ralstonia solanacearum* (bacterial wilt of potato). Available at: <https://doi.org/10.1079/cabicompndium.45009>.
- Cruz L, Eloy M, Quirino F, Oliveira H & Tenreiro R** (2012) Molecular epidemiology of *Ralstonia solanacearum* strains from plants and environmental sources in Portugal. *European Journal of Plant Pathology* **133**, 687-706.
- Department for Business & Trade** (2025) UK Strategic Export Control List.
- EFSA** (2019a) Pest survey card on potato brown rot, *Ralstonia solanacearum*. *EFSA Supporting Publications* **16**.
- EFSA PoPH** (2019b) Pest categorisation of the *Ralstonia solanacearum* species complex. *EFSA J* **17**, e05618.
- Elphinstone J & Matthews-Berry S** (2017) Monitoring and control of the potato brown rot bacterium in irrigation water. Defra.
- EPPO** (1997) *Ralstonia solanacearum* found on tomatoes in United Kingdom. In *EPPO Reporting Service*.
- EPPO** (2006) PM 10/1 (1) Disinfection procedures in potato production. *EPPO Bulletin* **36**, 463-466.
- EPPO** (2020) PM 3/089 (1) Control of volunteer potato plants. *EPPO Bulletin* **50**, 372-382.
- EPPO** (2022) PM 7/21 (3) *Ralstonia solanacearum*, *R. pseudosolanacearum* and, *R. syzygii* (*Ralstonia solanacearum* species complex). *EPPO Bulletin* **52**, 225-261.
- EPPO** (2023) PM 9/3 (3) *Ralstonia solanacearum*. *EPPO Bulletin* **53**, 604-612.

- EPPO** (2024a) PM 7/76 (6) Use of EPPO Diagnostic Standards. *EPPO Bulletin* **54**, 312-316.
- EPPO** (2024b) *Ralstonia solanacearum*. EPPO datasheets on pests recommended for regulation. Available at: <https://gd.eppo.int/> (accessed 14/06/2024).
- EPPO** (2025a) EPPO Datasheet: *Ralstonia pseudosolanacearum*. Available at: <https://gd.eppo.int/taxon/RALSPS/datasheet> (accessed 25/07/2025).
- EPPO** (2025b) EPPO Datasheet: *Ralstonia solanacearum*. Available at: <https://gd.eppo.int/taxon/RALSSL/datasheet> (accessed 25/07/2025).
- EPPO** (2025c) *Ralstonia pseudosolanacearum*. EPPO datasheets on pests recommended for regulation. Available at: <https://gd.eppo.int> (accessed 21/05/2025).
- EU** (2022) Commission Implementing Regulation (EU) 2022/1193 of 11 July 2022 establishing measures to eradicate and prevent the spread of *Ralstonia solanacearum* (Smith 1896) Yabuuchi et al. 1996 emend. Safni et al. 2014. *Official Journal of the European Union* **185**, 27-46.
- Fegan M & Prior P** (2005) *How complex is the Ralstonia solanacearum species complex*. In: C Allen, P Prior and AC Hayward (eds.). *Bacterial wilt disease and the Ralstonia solanacearum species complex*. American Phytopathological Society, St Paul, USA.
- Huet G** (2014) Breeding for resistances to *Ralstonia solanacearum*. *Front Plant Sci* **5**, 715.
- Jiang G, Wei Z, Xu J, Chen H, Zhang Y, She X, Macho AP, Ding W & Liao B** (2017) Bacterial Wilt in China: History, Current Status, and Future Perspectives. *Front Plant Sci* **8**, 1549.
- Karim Z, Hossain M & Begum M** (2018) *Ralstonia solanacearum*: A Threat to Potato Production in Bangladesh. *Fundamental and Applied Agriculture* **3**.
- Safni I, Cleenwerck I, De Vos P, Fegan M, Sly L & Kappler U** (2014) Polyphasic taxonomic revision of the *Ralstonia solanacearum* species complex: proposal to emend the descriptions of *Ralstonia solanacearum* and *Ralstonia syzygii* and reclassify current *R. syzygii* strains as *Ralstonia syzygii* subsp. *syzygii* subsp. nov., *R. solanacearum* phylotype IV strains as *Ralstonia syzygii* subsp. *indonesiensis* subsp. nov., banana blood disease bacterium strains as *Ralstonia syzygii* subsp. *celebesensis* subsp. nov. and *R. solanacearum* phylotype I and III strains as *Ralstonia pseudosolanacearum* sp. nov. *Int J Syst Evol Microbiol* **64**, 3087-3103.
- Wang Z, Luo W, Cheng S, Zhang H, Zong J & Zhang Z** (2023) *Ralstonia solanacearum* - A soil borne hidden enemy of plants: Research development in management strategies, their action mechanism and challenges. *Front Plant Sci* **14**, 1141902.
- Wenneker M, Beuningen Av, Nieuwenhuijze Av & Janse J** (1998) Survival of brown rot and disinfection of surface water. The survival of the brown rot bacteria (*Pseudomonas solanacearum*) in several substrates and the efficiency of several methods for the disinfection of surface water. *Gewasbescherming* **29**, 7–11.

Yabuuchi E, Kosako Y, Yano I, Hotta H & Nishiuchi Y (1995) Transfer of two Burkholderia and an Alcaligenes species to Ralstonia gen. Nov.: Proposal of Ralstonia pickettii (Ralston, Palleroni and Doudoroff 1973) comb. Nov., Ralstonia solanacearum (Smith 1896) comb. Nov. and Ralstonia eutropha (Davis 1969) comb. Nov. *Microbiol Immunol* **39**, 897-904.

Yuliar, Nion YA & Toyota K (2015) Recent trends in control methods for bacterial wilt diseases caused by Ralstonia solanacearum. *Microbes Environ* **30**, 1-11.

10. Authors and reviewers

Authors:

Aaron Hoyle & Enrique Carrion-Alegria (Defra)

Reviewers:

Laura Stevens (Defra)

Simon Honey (Defra)

Matthew Everatt (Defra)

Lucy Jackson (Defra)

Brian Carter (Fera Science Ltd.)

Ian Sanders (APHA)

Yvonne Hay (SASA)

Karen Fraser (SASA)

Colin Jefferies (SASA)