

Nurseries, Retailers and Landscapers

- Biosecurity Best Practice Protocols



The Food and Environment
Research Agency



CONTENTS

INTRODUCTION 2

NR&L1 SOURCING PLANTS 3

 Appendix 1..... 5

NR&L2 HANDLING PLANTS ON ARRIVAL 7

NR&L3 QUARANTINE AREAS 8

NR&L4 DESIGN & LAYOUT 11

NR&L5 RISK ASSESSMENT AND MONITORING 13

NR&L6 HUSBANDRY 16

NR&L7 HYGIENE..... 19

NR&L8 WATER MANAGEMENT 22

NR&L9 DISPOSAL OF PLANT WASTE..... 24

NR&L10 STAFF TRAINING 28

NR&L11 CUSTOMERS AND VISITORS..... 30

NR&L12 ON-SITE CONTRACTORS 31

NR&L13 *PHYTOPHTHORA RAMORUM* / *P. KERNOVIAE* -- OUTBREAK SITUATIONS..... 33

NR&L14 PLANT PASSPORTS 36

NR&L15 INFORMATION SOURCES FOR *PHYTOPHTHORA RAMORUM* & *P. KERNOVIAE*. 38

NR&L16 USE OF *PHYTOPHTHORA* LATERAL FLOW DEVICES (LFDs)..... 44

ACKNOWLEDGEMENTS 50

 Appendix 2..... 51

BIOSECURITY POSTER FOR NURSERIES AND GARDEN CENTRES 54

INTRODUCTION

1. In the last few years, a number of plant pests and diseases have been found for the first time in the United Kingdom and have caused significant damage to either our native flora or to commercial crops. These include, for example, *Phytophthora ramorum* and *Phytophthora kernoviae* affecting trees, heathland plants and heritage gardens; oak processionary moth (*Thaumetopoea processionea*) with its associated threat to human health; and horse chestnut bacterial canker (*Pseudomonas syringae pv. aesculi*).
2. These threats have increased with the globalisation of trade generally with a marked increase in the volume and diversity of plants and plant products entering the UK, and with climate change with warmer winters and increasing summer storms.
3. International and national legislative controls exist to reduce the risk of plant pests and diseases moving around the World. However, these controls cannot reduce the risk to zero.
4. Therefore, it is vital that everyone with an interest in our native flora or a stake in commercial crops or gardens take some simple steps themselves to further reduce the risk of introducing or spreading plant pests and diseases in the country.
5. These Best Practice Protocols provide helpful advice on the ‘biosecurity’ measures which can help to protect nurseries, retailers and landscapers from pest and disease attack. Although they have been written primarily for the control of two species of *Phytophthora*, *P. ramorum* and *P. kernoviae*, the measures are intended to offer protection generically across all plant pests and diseases. A complementary set of protocols have been produced for those involved in park, gardens and the wider environment.
6. The protocols were drafted by a small team of plant scientists at The Food and Environment Research Agency and a Working Group of professional stakeholders. You are invited to have a read, share them with your staff and pick out and implement any measures which you consider would help your business.

Dr David Slawson
The Food and Environment Research Agency

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NR&L1 SOURCING PLANTS

AIM:

- To reduce the risk of introducing *Phytophthora* onto a nursery or retail site on bought-in plants

WHY?

- Bought-in plants are the single most important way in which *Phytophthora* species (and many other pests and diseases) move between commercial premises
- Good sourcing practices will significantly reduce the risk of introduction

HOW?

- Ensure that you are aware of the plant subjects that are most susceptible to *Phytophthora* species, particularly the notifiable pathogens *Phytophthora ramorum* and *P. kernoviae* [Defra/Fera *P. ramorum* host list](#) [Defra/Fera *P. kernoviae* host list](#)
This will enable you, based on a risk assessment [See [NR&L5 on Risk assessment and monitoring](#)], to make informed decisions on such aspects as:
 - ~ The range of plants that you stock, and their sources
 - ~ Which plants will require close monitoring once they are on-site
 - ~ How to reduce the risk of disease outbreaks by appropriate placement of the plants on the site [See [NR&L4 on Design & layout](#)]
- Nurseries
 - ~ Wherever possible, propagate from your own stock plants, which you know to be free from disease
 - ~ If you need to buy in plants, consider purchasing micro-propagated or seed-raised material, which has less risk of being infected with *Phytophthora*
 - ~ Otherwise, source plants from a supplier with a good track record of supplying healthy, disease-free plants
- Retailers/landscapers
 - ~ Source plants from a nursery with a good track record of supplying healthy, disease-free stock
- Check whether your supplier belongs to an accreditation scheme. Members of such schemes are independently audited to ensure that they are legally compliant and reach required standards in various aspects of plant production, including pest and disease control. Schemes relevant to producers of nursery stock include:
 - ~ British Ornamental Plant Producers (BOPP)
 - ~ Linking Environment and Farming (LEAF)
 - ~ GLOBALG.A.P. Flowers and Ornamentals Standard
- Develop a relationship with your suppliers – if possible, visit them to check their operation. The appendix to this protocol lists items that could be assessed during such a visit

- Consider using a contract clause requiring that plants have not received an anti-*Phytophthora* fungicide in a six-week period prior to dispatch – fungicides can mask symptom development, but may not kill the *Phytophthora*
- Specify your exact plant requirements in your contract, and ensure that what you receive matches those requirements. [[See NR&L2 on Handling plants on arrival](#)]
- Ensure that plants, where required, have the correct official documentation – a phytosanitary certificate for plants imported from outside the European Union and a plant passport for movements of key susceptible species within the European Union. [[See NR&L14 on Plant passports](#)]
- Keep accurate records of all bought-in plant material, including the supplier, date of arrival, previous cropping history and treatments applied (liaise with the supplier over this), plant passport details where relevant (these must be retained for at least twelve months) and any batch or consignment numbers. Retain all invoices and official documents
- Landscapers – in addition to keeping purchase records as above, also maintain records of clients, locations, dates, etc. where material is planted out. This will enable accurate tracking by the relevant Plant Health Authority in the event of an outbreak of *Phytophthora ramorum* or *P. kernoviae* [[See NR&L13 on Outbreak situations](#)]
- Be aware that large, semi-mature plants may pose a higher risk of introducing *Phytophthora* and other pests and diseases than smaller, younger plants, as they can be more difficult to inspect for symptoms
- Avoid returned stock wherever possible. Otherwise, follow quarantine procedures outlined in best-practice protocol NRL3. [[See NR&L3 on Quarantine areas](#)]

Appendix 1

SUPPLIER CHECKLIST

N.B. It is always advisable to maintain a close relationship with your suppliers, and a reputable supplier should not object to your asking to visit their production site(s) and to discuss or view the various factors listed below.

If you have multiple suppliers and/or suppliers located considerable distances away, time and resource limitations may prevent you from carrying out the type of detailed visit to each supplier as listed below. However, if you are aware of other growers who purchase plants from the same suppliers, there may be scope for exchange of information between you. Remember that, if your supplier is a member of an accreditation scheme, it will have been independently audited.

	Check	Notes
<p>Nursery infrastructure: [See NR&L7 on Hygiene, NR&L6 on Husbandry and NR&L4 on Design & layout] (e.g. glasshouses, paths, benches, supports).</p> <p>Look for: In a good state of repair; clean, unbroken glass panes; tidy; free from old plants, plant debris and weeds; no signs of drainage or flooding problems.</p>		
<p>Watering / irrigation: [See NR&L8 on Water management]</p> <p>Look for: Supply: non-mains water should be subject to testing and disinfection; ideally low-level irrigation (e.g. drip-point watering or drained sandbeds) and preferably not overhead irrigation that can spread <i>Phytophthora</i>; end-of-season disinfection of irrigation lines; replacement or disinfection of capillary matting.</p>		
<p>Source or origin of plants (their provenance):</p> <p>Look for: evidence that the nursery knows the origin of their plants – ask specifically where the nursery and their suppliers source their plants.</p>		
<p>Documentation:</p> <p>Look for: delivery notes to confirm that plants comply with all necessary plant health legislation, e.g. plant passport requirements, name of supplier and origin of material.</p>		

<p>Plant husbandry and health:</p> <p><i>Look for:</i> healthy, vigorous plants; plants not growing in standing water or fallen over (where they can pick up <i>Phytophthora</i>); correct watering, nutrition and growing conditions, not pot bound, not too soft or leggy; good plant-handling systems avoiding unnecessary plant damage and the risk of cross-infection; no visible evidence of <i>Phytophthora</i> symptoms.</p>		
<p>Pesticides:</p> <p><i>Look for:</i> responsible use of pesticides; consider a contract clause stating that the plants have not been sprayed with anti-<i>Phytophthora</i> fungicides for six weeks prior to supply, because of the risk that these fungicides may mask infection.</p>		
<p>Phytophthora status:</p> <p><i>Look for:</i> signs of disease on plants, including those surrounding the nursery; ask about any previous outbreaks and reassure yourself that the nursery is now disease free.</p>		
<p>Waste management: [See NR&L9 on Disposal of plant waste]</p> <p><i>Look for:</i> appropriate disposal of used material; any waste; tips sited well away from production areas, with no risk of water movement to production areas.</p>		

NR&L2 HANDLING PLANTS ON ARRIVAL

AIM:

- To reduce the risk of introducing *Phytophthora* onto a nursery or retail site on bought-in plants

WHY?:

- Bought-in plants are the most important way in which *Phytophthora* species (and many other pests and diseases) are introduced onto a nursery or retail site
- Careful checking of plants on arrival will significantly reduce the risk of introduction

HOW?:

- On arrival, plants must be checked carefully:
 - ~ In an unloading area away from the main points of production or retail; ideally, in a separate unloading area for a quarantine facility [See [NR&L3 on Quarantine areas](#)]
 - ~ By staff competent in recognising the symptoms caused by *Phytophthora* species and other pests and diseases, and in the necessary administrative and reporting procedures [See [NR&L10 on Staff training](#)]
 - ~ Appropriate hygiene measures should be taken during and after the checking process [See [NR&L7 on Hygiene](#)]
- Check all necessary documentation to ensure compliance to your order and, if they are needed for the plants in question, any phytosanitary certificates or plant passport numbers [See [NR&L14 on Plant passports](#)]
- Only accept the delivery if you are content that the plants are free from *Phytophthora* and other pests, diseases and weeds, and that all of the paperwork is in order
- If suspect symptoms are present, lateral flow devices (LFDs) can be useful in determining whether *Phytophthora* is responsible [See [NR&L16 on Use of LFDs](#)]
- Inform your supplier immediately of any problems. This will be so much easier if your exact requirements were specified on the original contract/purchase order
- Sign, date and retain your copy of the delivery note to confirm that the plants have been checked and are acceptable
- Record the delivery as an accession on any plant database
- Keep accurate records of all bought-in plant material, including the supplier, date of arrival, previous cropping history and treatments applied (liaise with the supplier over these), plant passport details where relevant (these must be retained for at least twelve months), and any batch or consignment numbers. Retain all invoices and delivery notes
- Consider placing the plants in a quarantine area for a monitoring period – check regularly for the development of disease symptoms [See [NR&L3 on Quarantine areas](#)]

NR&L3 QUARANTINE AREAS

AIM:

- To reduce the risk of introducing *Phytophthora* onto a nursery or retail site on bought-in plants

WHY?:

- Bought-in plants are the single most important way in which *Phytophthora* species (and many other pests and diseases) are introduced onto a nursery or retail site
- Careful checking of plants on arrival [[See NR&L2 on Handling plants on arrival](#)], followed by a period in a dedicated quarantine area, will significantly reduce the risk of introduction

HOW?:

A quarantine area allows plants to be monitored for pest and disease development before they are moved around the nursery. A separate quarantine area may be impractical for some nurseries or garden centres where there is a large and rapid throughput of stock – in this case the development of a close relationship with suppliers, with regular inspections if possible, is particularly important [[See NR&L1 on Sourcing plants](#)]. Attention paid to the design and layout of the site will also help to reduce the impact of any possible outbreak [[See NR&L4 on Design & layout](#)]

A quarantine area:

- Can range from a separate, outdoor, holding area to (preferably) a protected structure, such as a modified section of an existing glasshouse (with its own entrance), or even a purpose-built glasshouse or polytunnel
- Should be 'isolated' from production or retail areas - geographically (e.g. on the nursery boundary) or by access restrictions
- Should be at least ten metres from any hosts of *Phytophthora ramorum* or *P. kernoviae* outside the quarantine area (to avoid these being included in a Statutory Notice, should one of these pathogens be found on the plants in the quarantine area)
- Should have a single entry point, with signs limiting access, and its own loading / unloading area
- Should have an easily cleaned and disinfected (e.g. concrete) floor
- Should be designed to prevent the accumulation of standing water, and to prevent water running out into, or entering from, other parts of the nursery

Staff using the quarantine area:

- Should be restricted in number to a few nominated, trained staff [See [NR&L10 on Staff training](#)]
- Should wash / disinfect footwear prior to entering and leaving the area [See [NR&L7 on Hygiene](#)]. Provide washing bowls, brushes, soapy water and disinfectant at the entrance

Husbandry information / hygiene:

- Ensure that plants in the quarantine area are well-spaced and have good growing conditions
- Avoid overhead irrigation, if possible, as this can spread *Phytophthora* and other pathogens
- Control weeds in and around the quarantine area
- Take measures to exclude animals (foxes, badgers, deer, mice, cats, dogs, etc.) that could spread plant pests and diseases
- Use tools and equipment (e.g. Danish trolleys) dedicated to the area – colour-code or clearly mark them to help with this. Clean and disinfect them regularly
- Do not use anti-*Phytophthora* fungicides for a minimum of six weeks after taking delivery of the plants
- Collect and transport plant waste from the quarantine area in sealed bags or containers. Dispose of it in an appropriate manner [See [NR&L9 on Disposal of waste](#)]

Monitoring: [See [NR&L5 on Risk assessment & monitoring](#)]

- Monitor plants for a minimum of two weeks if you are confident that no anti-*Phytophthora* fungicides have been used by the supplier prior to dispatch of the plants [See [NR&L1 on Sourcing plants](#)]. This period should be increased if the weather is cold or dry immediately after receipt of the plants
- If there is a possibility that anti-*Phytophthora* fungicides have been used prior to dispatch of the plants, the monitoring period should, where possible, be increased to six weeks. This will allow time for fungicide residues to decline, following which any *Phytophthora* present may become active again and produce symptoms
- Monitor plants at least weekly (daily is better) and consider the use of lateral flow devices (LFDs) to help identify symptoms caused by *Phytophthora* [See [NR&L16 on Use of LFDs](#)]
- Inform the relevant Plant Health Authority if you find symptoms that you suspect could be due to *Phytophthora ramorum* or *P. kernoviae* [See [NR&L13 on Outbreak situations](#)]
- In specific cases (e.g. dormant deciduous plants arriving on-site many weeks before they leaf out, or young module plants requiring immediate potting on), the use of the quarantine

area may be impractical, or of limited effectiveness. In these cases, the threat can be reduced by risk assessment and planning, for example by avoiding this type of material or delivery time, where possible, for known key hosts of *Phytophthora ramorum* or *P. kernoviae*. If such material is used, it should be monitored very closely when placed out on the nursery, and where possible situated more than ten metres from other hosts of these pathogens

NR&L4 DESIGN & LAYOUT

AIM:

- To reduce the risk of introducing and spreading *Phytophthora* species (and other pests and diseases) through appropriate design & layout of the nursery or retail site

WHY?:

- There are certain key pathways by which pests and pathogens can arrive at a nursery or retail site, and subsequently spread through it. These include arrival on bought-in plants, and subsequent spread via contaminated debris, tools or water
- Some areas of a site are likely to be at greater risk of *Phytophthora* diseases as a result of their microclimate, drainage, etc. Prior knowledge of these areas will enable the risk of a significant outbreak to be reduced through planning, monitoring and, if appropriate, remedial action

HOW?:

Consideration of the following aspects will help to reduce the risk of outbreaks or spread of *Phytophthora* diseases, and also of many other pests and pathogens:

Plant arrival and quarantine areas

[See [NR&L2](#) on Handling plants on arrival, and [NR&L3](#) on Quarantine areas]

- Quarantine areas (and any associated drainage systems) should be isolated from the main production or retail areas
- There should be a loading / unloading area with direct access to the quarantine area

Disposal of plant waste

[See [NR&L9](#) on Disposal of plant waste]

- Points where plant waste is processed, or is held prior to incineration or disposal to landfill, should ideally be sited downwind from, and downhill from, the main production or retail areas, so that there is less risk of wind- or water-borne debris spreading back into those areas
- They should also be sited well away from water sources such as streams, rivers and reservoirs

General site layout

[See [NR&L5](#) on Risk assessment and monitoring]

- Produce a site layout map showing the locations of host plants, which, together with the results of a risk assessment, will enable the identification of high-risk areas. In these areas:
 - ~ Carry out more frequent monitoring
 - ~ Preferably, avoid stocking with susceptible plants in the first place - for example, avoid placing hosts susceptible to *Phytophthora ramorum* or *P. kernoviae* [Defra / Fera P. ramorum host list](#) [Defra / Fera P. kernoviae host list](#) (or other diseases favoured by prolonged leaf wetness) in an area with overhead irrigation or poor air circulation / high humidity.
 - ~ Producers of field-grown stock should avoid placing hosts susceptible to root-infecting *Phytophthora* species in areas with poor drainage, or where the disease has occurred previously
- On larger production nurseries, try to keep blocks of the main susceptible hosts of *Phytophthora ramorum* or *P. kernoviae* (e.g. *Camellia*, *Leucothoe*, *Magnolia*, *Pieris*, *Rhododendron*, *Viburnum*) separate and spaced at least ten metres apart. This will ensure that, should one of these pathogens be found, only the block immediately around the affected plants will be subject to statutory control measures. [See [NR&L13 on Outbreak situations](#)] On smaller nurseries and on retail sites achieving this degree of separation can be more difficult
- Many of the main hosts of *Phytophthora ramorum* or *P. kernoviae* (see above) are acid-loving plants, and as such are often displayed together in one area of a retail site. An 'A-Z by genus' sales area would pose less of a risk, should there be an outbreak, of large numbers of host plants being subject to statutory control measures (assuming that the outbreak is confined to just one or two genera). However, this will only be effective if the sales area is large enough to ensure wide separation of the different susceptible plant genera
- Retailers should avoid splitting up a batch of a host plant from the same delivery and placing it at different points in the sales area. If there is an outbreak of *Phytophthora ramorum* or *P. kernoviae* arising from the batch this could lead to numerous areas becoming subject to statutory control measures
- Where it is practical for the range of host plants grown, production nurseries should aim to rotate container crops, so that known host plants are not located for at least six months on beds previously occupied by susceptible species

NR&L5 RISK ASSESSMENT AND MONITORING

AIM:

- To identify those nurseries and retail sites, and the areas within them, most at risk from infection by *Phytophthora ramorum* and *P. kernoviae*
- To detect any outbreaks as early as possible by the routine monitoring of potential host plants

WHY?:

- Some nurseries and garden centres are more at risk from *Phytophthora ramorum* and *P. kernoviae* than others. Within a particular nursery there will also be certain areas that are at greater risk. The risk will depend on factors such as the geographical location of the site (e.g. proximity to other cases of the disease, local climate in terms of rainfall and temperature), the microclimate in different parts of the site, and the number, location and stocking density of the various plant species susceptible to the pathogens
- Any nursery or retail site buying in plants of susceptible hosts is at risk of importing these pathogens, however
- Identification of high-risk areas, together with frequent monitoring of host plants in all parts of the site, will give a greater chance of detecting and eradicating outbreaks before they become more widespread

HOW?:

Risk assessment

The following should be considered when assessing the risk of *Phytophthora ramorum* or *P. kernoviae* outbreaks for a nursery or retail site as a whole, or for specific areas within it:

- Information on the prevalence of other findings in the local area. For example, whilst not providing details of specific outbreak sites, Defra and the Forestry Commission produce maps showing the distribution of outbreaks in the UK (Defra maps show outbreaks in the natural environment in England and Wales only)
 - ~ [FC P. Ramorum Distribution](#) [Fera P. ramorum distribution](#) [Fera P. kernoviae distribution](#)
- Information on the prevailing climate (clearly, this is most relevant to outdoor cropping or sales areas). Outbreaks are more likely to occur in areas with high summer rainfall and high relative humidity (e.g. south-west England) than in those with a drier climate – although there are many exceptions
- The quantity and range of susceptible host plants [Defra / Fera P. ramorum host list](#) [Defra / Fera P. kernoviae host list](#) produced and/or sold at the site
- The quantity and range of these hosts bought-in from other nurseries, and the number of nurseries from which the plants are obtained. The risk is likely to be higher if:

- ~ Large quantities, of a wide range, of susceptible plants are bought-in
- ~ The plants are obtained from a large number of different nurseries
- Steps can be taken to reduce the risk, however, by following the appropriate best-practice protocols [See [NR&L1 on Sourcing plants](#), [NR&L2 on Handling plants on arrival](#), and [NR&L3 on Quarantine areas](#)]
- The numbers grown or sold of certain ‘key’ hosts, on which the disease has been found most often in the UK and Europe, notably *Camellia*, *Pieris*, *Rhododendron* and *Viburnum*
- The microclimate in which the plants are kept. Examples where the risk of outbreaks or disease spread is increased include dense plant canopies (e.g. where plants are stood pot-thick), the use of overhead irrigation, and the growing of plants in areas with poor air circulation or in polytunnels or glasshouses with poor control of relative humidity
- The amount of attention given to husbandry, hygiene and water management techniques aimed at reducing the risks of infection. Following the measures outlined in the appropriate best-practice protocols can greatly reduce the risk [See [NR&L6 on Husbandry](#), [NR&L7 on Hygiene](#) and [NR&L8 on Water management](#)]

Monitoring

All staff working with host plants should receive training in, or be made aware of, *Phytophthora ramorum* and *P. kernoviae* (e.g. common and ‘key’ host plants, symptoms, methods of spread, hygiene measures, etc.). [See [NR&L10 on Staff training](#)] This will enable them to check for suspected cases whilst undertaking their normal duties. However, specific and regular surveillance of the site for symptoms caused by these pathogens will increase the chances of early detection.

- The monitoring should ideally be undertaken by the same staff on each occasion, so that they are familiar with the locations of high risk-areas, and of previous suspect cases and their outcomes
- These staff should familiarise themselves with the symptoms caused by the pathogens on as many of the host plants grown or sold on the site as possible [See [NR&L15 on Information sources](#)] [Fera Information](#) [FC information](#)
- The staff should ideally be aware of other diseases, pests and disorders causing similar symptoms; although, if there is any doubt as to the cause, then it should be dealt with as a suspected case of *P. ramorum* or *P. kernoviae*
- The frequency of monitoring should be related to the time of year. Spring, summer and early autumn are most important, as the disease is more likely to be spreading at these times, and deciduous hosts will have leaves present. Consider weekly or fortnightly monitoring at these times, particularly if weather conditions are favourable for the pathogens (i.e. mild and wet). Monitoring can be less frequent in winter and should concentrate on evergreen hosts (although symptoms of bleeding canker on deciduous trees may still be obvious)

- Monitoring should include stock plants, liners and newly-propagated material
- Check the boundaries of the site (e.g. hedgerows) for host plants, and include these in the monitoring schedule
- The production of a layout map showing the locations of host plants, together with the results of a risk assessment (see above) will enable the targeting and prioritisation of high-risk areas
- The location where bought-in plants are received is a particularly high-risk area - this is best dealt with by the use of a quarantine area, which will need very frequent monitoring
[See [NR&L3 on Quarantine areas](#)]
- Consider the use of lateral flow devices (LFDs) to test suspect symptoms for the presence of *Phytophthora* (N.B. these tests are not specific for *P.ramorum* or *P.kernoviae*). Staff undertaking the monitoring should be given training in their use [See [NR&L16 on Use of LFDs](#)], [Forsite](#)
- The staff should be given full training in hygiene techniques associated with working in disease-affected areas and the testing of potentially infected material [See [NR&L7 on Hygiene](#)]
- Staff undertaking monitoring should be familiar with the action to be taken with regard to the reporting of suspect cases [See [NR&L13 on Outbreak situations](#)]

NR&L6 HUSBANDRY

AIM:

- To use husbandry techniques that minimise the risk of the outbreak or spread of *Phytophthora* diseases (and of many other pests and diseases)

WHY?:

- Whilst many pathogens (including *Phytophthora* species) are capable of attacking vigorous, healthy plants, a stressed plant is likely to succumb to disease more rapidly. Some other pathogens can only attack a plant that has been previously weakened or damaged in some way
- Good husbandry techniques can also prevent the pathogen from coming into contact with its host plant in the first place or, if contact is made, can reduce disease levels by creating environmental conditions that are unfavourable for the pathogen

HOW?:

Environmental conditions

Prolonged leaf wetness or high relative humidity is favourable for the development of many foliar pathogens, including species of *Phytophthora* (such as *P. ramorum* and *P. kernoviae*) that attack the aerial parts of plants. It may be possible to manipulate the environment to produce conditions that are less favourable for infection:

- Avoid overhead irrigation if possible; low-level irrigation systems prevent leaf wetness [See [NR&L8 on Water management](#)]
- If watering overhead avoid, where possible, doing so in the evening or overnight, as this often results in lengthy periods of leaf wetness
- Keep glasshouses and polytunnels in good order to avoid drips and leaks
- Keep such structures well-ventilated to lower the relative humidity. If heating is available, a combination of venting and heating will be effective during the winter months
- The use of fans to circulate air within such structures will also help
- Precise humidity control is more difficult outdoors, but spacing plants well allows for better air circulation and reduces pockets of 'stagnant' air

Nutrition

- Monitor both plants and compost/soil regularly for nutrient deficiencies
- Correct significant deficiencies using fertilisers or foliar feeds

- Avoid overuse of nitrogenous fertilisers, or the use of fertilisers in late summer/autumn – this can promote soft growth that is susceptible to damage and infection

Pruning/trimming & plant handling

- Pruning or trimming of plants during dry weather allows cut surfaces time to heal, whilst conditions are unfavourable for pathogens (including species of *Phytophthora* causing aerial infection) that might colonise the wounded tissue
- Take appropriate hygiene precautions during pruning or trimming operations, particularly if removing diseased material [See [NR&L7 on Hygiene](#)]
- Consider the application of a fungicide after this type of operation, to provide additional protection for wounded tissues
- Handle plants with care at all times to avoid damaging the branches and foliage

Avoiding soil contamination of foliage

Soil or compost debris splashed onto the lower leaves by heavy rain or overhead irrigation can result in aerial parts of the plant picking up infection from the soil. To help to prevent this:

- Mulch the surface around soil-grown plants (particularly stock plants) - of course, this has other important benefits, such as preventing water loss, suppressing weeds and, depending on the mulch used, adding organic matter and nutrients to the soil
- Consider the use of a material to cover the compost surface of container-grown plants (e.g. pot-toppers or bark chips) - which again gives additional benefits such as the suppression of weeds and mosses/liverworts
- Avoid taking cuttings from branches of stock plants that could have experienced soil-splash – there is a high risk of introducing *Phytophthora* (and other soil-borne pathogens such as *Pythium*, *Rhizoctonia* and *Thielaviopsis*) into the propagation area
- If plants on standing areas have been blown over by strong winds, pick them up as soon as possible

Use of fungicides:

Fungicides can have a role to play in the prevention and control of *Phytophthora* diseases. However, there are certain points to bear in mind:

- Most anti-*Phytophthora* fungicides do not kill the pathogen, but only check its growth. The *Phytophthora* may become active again once the effect of the fungicide has worn off
- Systemic fungicides will be less effective during the winter, when translocation is reduced

- It is not permitted to use anti-*Phytophthora* fungicides on plants subject to a holding order for *Phytophthora ramorum* or *P. kernoviae* [See [NR&L13 on Outbreak situations](#)]
- There should be less of a need to rely on fungicides if attention is paid to the other bio-security measures outlined in these best-practice protocols

Seek professional advice on the use of fungicides. [Liaison](#) is a subscription service from the Food and Environment Research Agency, which contains information on registered agrochemical products for all UK crops.

Materials such as compost teas and mycorrhizal root inoculants are sometimes used as alternative treatments, or in conjunction with fungicides. The efficacy of these treatments is still the subject of research.

NR&L7 HYGIENE

[See [NR&L6](#) on Husbandry and [NR&L8](#) on Water management, which need to be read in conjunction with this protocol]

AIM:

- To reduce the risk of spreading *Phytophthora* (and many other pests and diseases) within and between nurseries and retail sites, by the use of appropriate hygiene methods

WHY?:

- *Phytophthora* species, including *P. ramorum* and *P. kernoviae*, produce long-lived resting spores that contaminate pots, trays, growing media, etc. If soil is contaminated then this may persist for several years
- Strict hygiene measures will greatly reduce the risk of contamination and spread, not only of diseases caused by *Phytophthora* but also other fungal, bacterial and virus diseases, and even some pests

HOW?:

Contaminated plant debris, soil and compost

[See [NR&L9](#) on Disposal of plant waste]

These are very common sources of *Phytophthora*. The leaves and shoots of plants affected by aerial *Phytophthora* diseases (including those caused by *P. ramorum* and *P. kernoviae*) frequently contain resting spores that will be released as the material rots down. Similarly, plants affected by root-infecting *Phytophthora* species are likely to harbour resting spores in the roots and stem base. The action points below are also applicable to many other diseases and pests, e.g. re-used pots can be contaminated by pathogens such as *Pythium*, *Rhizoctonia* and *Thielaviopsis*, as well as *Phytophthora*.

- Monitor cropping and/or sales areas regularly to spot early signs of disease [See [NR&L5](#) on Risk assessment and monitoring]
- Where disease or pest problems are present, work the healthy parts of the crop first
- Bag up affected plants before removal, and remove the diseased material from the area as soon as possible
- Site skips or disposal areas as far away, and downwind from, cropping or sales areas and collection or storage points for irrigation water, growing media, pots, etc. Also consider potential water flows (not only water courses, but also water running down slopes) and avoid sites where water could carry plant material or pathogen propagules from the disposal area to other parts of the nursery

- Ensure that skips are covered
- If *Phytophthora ramorum* or *P. kernoviae* is present, disposal of affected plants should be done in accordance with the Statutory Notice issued by the relevant Plant Health Authority [See [NR&L13 on Outbreak situations](#)]
- Remove plant and compost debris from production and sales areas regularly, even if no pest or disease problems are obvious
- Cover any items that could be exposed to contaminated plant debris, soil or compost blowing around the site e.g. pots/trays, bulk compost storage areas, water storage tanks
- Use new pots and trays whenever possible
- Treat any re-used pots and trays with a disinfectant (see below for further information on disinfectants)
- The brief period before re-stocking, when cropping or sales beds and benches are empty, provides an ideal opportunity for a thorough clean-up. Remove all debris and wash/disinfect everything that could carry *Phytophthora* and other pathogens or pests over to the new stock
- The use of a permeable membrane (e.g. Mypex) over capillary matting or soil/gravel/sand-based standing areas allows for debris to be swept up relatively easily
- Avoid standing container-grown plants directly onto soil. The roots may come into contact with resting spores of root-infecting *Phytophthora* species within the soil. Soil containing the resting spores of species causing diseases of aerial parts (including *Phytophthora ramorum* and *P. kernoviae*) could be splashed onto the foliage

Tools and equipment (including footwear)

- Tools and equipment should be cleaned and disinfected regularly (see below for further information on disinfectants)
- Secateurs, pruning saws and cutting knives carry a high risk of transferring a range of diseases. They should be cleaned and treated frequently, even between individual plants if removing diseased plant parts or taking cutting material

Hand hygiene

- Hands should be protected from contamination or cleaned regularly, particularly if working with infected plants or in known infected areas
- Hands can be washed in hot, soapy water, but a practical alternative if there are no washing facilities in the immediate vicinity is the use of proprietary hand gels or foams. If gloves are worn, these should either be of a disposable type or cleaned regularly

Propagation material

- Only use cutting material from healthy, disease-free plants. If required, stock plants can be laboratory tested to check for the presence of *Phytophthora* and other pathogens [See [NR&L15 on Information sources](#)]
- Do not take cuttings from branches close to the soil or growing medium – these could be contaminated by water-splashed soil or compost containing resting spores
- Clean and disinfect cutting knives and secateurs very regularly (see below for further information on disinfectants)
- Wash hands regularly or use a proprietary hand gel/foam or disposable gloves
- Practice scrupulous hygiene in the propagation area – material infected here has the potential to spread disease very widely and very quickly both within and between nurseries or retail sites

Use of disinfectants

The following should be cleaned and treated regularly with a disinfectant active against *Phytophthora* (essential in areas where the disease is present):

- Tools and equipment (including footwear)
- Re-used pots and trays (ideally use new ones)
- Re-used Mypex and capillary matting (this may allow use for more than one year, but they should still be replaced regularly)
- Sand/gravel/concrete standing areas
- Water storage tanks and irrigation systems (e.g. drip lines, capillary sand beds)
- Glasshouse floor and structure (check that the product is safe to use on metal)

Seek professional advice on the use of disinfectants and soil sterilisers.

In laboratory tests, disinfectants based on 70% denatured ethanol (IMS) have proved most effective against *P. ramorum*.

There are many proprietary disinfectant products available. Some disinfectants (e.g. quaternary ammonium compounds) are quickly inactivated by organic debris, so items to be treated should be cleaned and washed thoroughly first to remove as much debris or compost as possible. Products have various recommendations for use as sprays, fogs, dips, etc. Some products produce harmful vapours that can damage plants; others can be used safely with plants nearby.

These types of disinfectant are not suitable (and most cannot be used legally) as soil treatments. Where soil contamination with *Phytophthora* has occurred, use of a specific soil sterilant or biofumigant could be considered (if *P. ramorum* or *P. kernoviae* is present, treatment should be done in accordance with the Statutory Notice issued by the relevant Plant Health Authority).

NR&L8 WATER MANAGEMENT

AIM:

- To reduce the risk of spreading *Phytophthora* on your premises

WHY?:

- *Phytophthora* (and *Pythium*) species are known commonly as ‘water moulds’
- The diseases that they cause can spread rapidly if untreated, contaminated water is used for irrigation
- Poor drainage / waterlogging and standing water provide ideal conditions for the spread of root-infecting *Phytophthora* and *Pythium* species. The localised high humidity found in these areas, and the risk of mud- and water-splash, are also favourable for outbreaks of many foliar pathogens, including *Phytophthora ramorum* and *P. kernoviae*

HOW?:

- Consider your source of irrigation water:
 - ~ Mains water should be free from pathogens, but is expensive and subject to restrictions on use
 - ~ Borehole water, if available, is usually pathogen-free
 - ~ River or reservoir water may contain *Phytophthora*, *Pythium* and other pathogens
 - ~ Water collected on-site can pose a significant risk, particularly if it has been obtained as run-off from beds
- Test water collected on-site or abstracted from rivers or reservoirs for *Phytophthora*, at regular intervals (at least annually). Whatever the source, water should be tested if it is re-used or stored before use
- Ensure that water storage tanks are covered, to prevent contamination with plant, soil or compost debris that could contain spores of *Phytophthora* and other pathogens
- If water is re-used, or obtained from a high-risk source (see above), it should be treated prior to application to crops. Treatment methods include slow sand filtration, ultra-violet light, chlorination and ozone treatment – suitability for a given situation will vary according to factors such as the volume of water requiring treatment, the cost of the various systems and the available space on the nursery (e.g. for sand filters), and should be determined on a case-by-case basis
- Consider your irrigation method:
 - ~ Overhead irrigation poses the greatest risk of spreading *P. ramorum* / *P. kernoviae* and many other foliar diseases. Ensure that it is used in a controlled way to minimise water splash. Avoid evening or night-time irrigation, if possible, as this can result in extended periods of leaf wetness that are conducive to infection by many foliar pathogens

- ~ Sub-irrigation methods (e.g. capillary sand-beds, drip lines, capillary matting with lay-flat tubing), when appropriate and economic for the crop, avoid leaf wetness and are therefore of lower risk
- ~ Whichever method is used, do not overwater!
- Growing plants in a protected structure (glasshouse or polytunnel) will give protection against rain-splash of spores. However, the higher humidities often found in such structures can still lead to significant outbreaks of some foliar diseases
- Use appropriate husbandry techniques to reduce the risk of infection and spread of diseases caused by *Phytophthora* and other water-borne pathogens:
 - ~ Regularly clean and disinfect water storage tanks, and flush through irrigation lines periodically with a suitable disinfectant
 - ~ Change or disinfect capillary matting between crops
 - ~ Maintain and repair paths and standing areas to prevent puddling of water
 - ~ Improve drainage of soil-grown crops where there is a risk of waterlogging
 - ~ If using a hose or lance for irrigation, do not allow the end to come into contact with the floor or soil – it may become contaminated with soil or debris containing spores of *Phytophthora*, *Pythium* and other pathogens
 - ~ Use barriers and/or drains where appropriate to prevent water run-off from bed to bed

NR&L9 DISPOSAL OF PLANT WASTE

AIM:

- To ensure that all plant waste is disposed of in a safe manner, without risk of spreading disease or damaging the environment

WHY?:

- All plant waste (e.g. dead plants, fallen leaves, prunings) has the potential to harbour pests and diseases, including *Phytophthora* species. These could be spread around a nursery or garden centre if the waste is moved or disposed of in an uncontrolled manner
- Regulations are also in place to ensure that waste is recovered or disposed of without endangering human health or the environment

HOW?:

N.B. Where an outbreak of a notifiable pathogen such as *Phytophthora ramorum* or *P. kernoviae* has occurred, the destruction of affected material (usually by burning, or by deep burial at an approved landfill site) will need to be carried out under a Statutory Notice issued by the relevant Plant Health Authority. Usually, such notices also require the destruction of associated containers, and of soils or growing media that have been used with the diseased plants. Statutory Notices carry a deadline for implementation. [[See NR&L13 on outbreak situations](#)]

The rest of this protocol deals with the routine disposal of plant waste when there is no notifiable pest or pathogen present, although the material may well contain a number of other pest or disease organisms (including other species of *Phytophthora*).

Collection of plant waste

- Material that is obviously diseased, and which poses a risk to other plants, should be bagged up and/or removed in a covered container. It would also be prudent to do this with any other plant material (e.g. prunings, senescent leaves or flowers) removed from production areas, even if the material is not obviously diseased
- Take suitable hygiene precautions when dealing with diseased material [[See NR&L7 on Hygiene](#)]
- Site skips or disposal areas as far away, and downwind from, cropping or sales areas and collection or storage points for irrigation water, growing media, pots, etc. Also consider potential water flows (not only water courses, but also water running down slopes) and avoid sites where water could carry plant material or pathogen propagules from the disposal area to other parts of the nursery
- Ensure that skips are covered

Disposal of Plant Waste

General information

In 2006, agricultural (including horticultural) waste was incorporated into the regulations that control the management of other commercial and industrial waste. In order to ensure that waste is recovered or disposed of without endangering human health or harming the environment, a permit is required by any establishment or undertaking carrying out a waste-management activity. In England and Wales, these permits are issued by the Environment Agency under the Environmental Permitting Regulations (England and Wales) 2010. Separate rules and regulations are in place in Scotland and Northern Ireland.

However, many of the waste treatment and disposal operations carried out by the agricultural and horticultural industries can be registered as 'exemptions' with the Environment Agency, meaning that a full permit is not required. It is currently free to register for such exemptions. Details of exemptions (and other relevant rules) are given under the appropriate handling or disposal method.

There are a number of methods available to nurseries, garden centres and landscapers for the disposal of plant waste. They include:

- Composting – this could be done on-site for nurseries or landscapers producing large amounts of plant waste. Alternatively, material could be supplied to local authorities or private companies engaged in green waste composting activities
- Burning
- Disposal to landfill

Composting

In addition to providing nutrients and organic matter, composting can also eliminate pests and pathogens, if done correctly. Companies may be able to negotiate a supply of their green waste to local authorities or private companies with composting operations. Supply of green waste to a local authority for compost production is often cheaper than sending it to the same authority's landfill sites.

Larger nurseries or landscapers, producing substantial amounts of green waste, may wish to consider their own composting systems. However, you should ensure that:

- The composting facility is sited and organised in such a way that there is no threat of the transfer of pests or diseases to production areas from the material to be composted
- You are fully aware of the relevant legislation, e.g. the Environmental Permitting Regulations in England and Wales. Large-scale composting will require a full permit (currently SR2010no14); composting on a smaller scale is permissible under Exemption T23. If you intend to collect or import green waste from other companies for composting you may also need relevant permits, exemptions or registrations
[Environment Agency 117109 \(Exemption T23\)](#)
[Environment Agency 117226 \(SR2010no14\)](#)

- You have identified an end use or market for the compost produced. For example, is the composting system to be entered into relevant certification and standards schemes, such as PAS100 and Quality Compost Control?

[Organics](#)

[Environment Agency GEHO0610BSVC-E-E](#)

The two most common types of composting are:

- Heaps or windrows
- In-vessel systems, e.g. containers, silos, rotating drums

In-vessel systems give greater control over environmental conditions, and, as they are enclosed, there is also less risk of spreading pathogens (in some cases this enables meat products to be composted as well as vegetable matter). Heap or windrow systems are usually less expensive per equivalent volume of material treated.

- Both types of composting are exothermic, relying on the generation of high temperatures
- Both types are aerobic – the microorganisms breaking down the plant matter require oxygen
- Macerated or shredded material will compost faster than bulky items
- Heaps or windrows must be turned regularly to ensure there is sufficient aeration (otherwise anaerobic conditions and foul odours may develop) and that no material stays permanently on the outside, where temperatures are much lower than within the heap. It is possible to set up an aerated heap or windrow system, in which air is sucked or blown through the compost
- Some in-vessel systems macerate, turn and aerate the material automatically
- To eliminate most pests and diseases, temperatures should reach at least 55°C for a continuous period of two weeks, or 65° for a continuous period of one week (at least 60°C for enclosed systems) (Reference: EPPO PM 3/66 *Guidelines for the management of plant health risks of biowaste of plant origin*). These temperatures have been sufficient to kill resting spores of *Phytophthora* species in various research projects
- Pathogens producing very resilient resting spores may require higher temperatures

Burning

Material can be burned:

- On-site. Exemption D6 covers the burning of plant waste in an incinerator, whilst Exemption D7 covers the burning of plant waste in the open. As with composting, there are limits to the amount of material that can be processed in these ways at any one time

[Environment Agency 117125 \(Exemption D6\)](#)

[Environment Agency 117127 \(Exemption D7\)](#)

- Off-site at a commercial incinerator

Landfill

- Waste material intended for landfill at a local-authority-approved landfill site is subject to various regulations, primarily the Landfill Directive
- The producer of the waste has a duty of care, under this directive, to ensure that the waste is only delivered to a site capable of dealing with waste of that type. If a waste carrier is used to collect the waste, the producer of the waste must check that the carrier is licensed with the Environment Agency
- The NetRegs waste directory allows a producer of waste to search for local sites for disposal or recycling, and also local carriers, of various waste materials, including green wastes [waste directory](#)
- Under the Landfill Directive, nearly all waste must be treated in some way before it is sent to landfill, so that part of it is recycled, its volume is reduced or its hazard reduced in some way. In terms of plant waste, examples of treatment include composting or burning

Further details on the Landfill Directive are available from the Environment Agency.

[Environment Agency 89988](#)

General guidance for the treatment of horticultural waste to minimise plant health risks is available in the Food and Environment Research Agency (Fera) document [Code of Practice](#).

NR&L10 STAFF TRAINING

AIM:

- To familiarise staff with the symptoms caused by *Phytophthora* diseases such as *P. ramorum* and *P. kernoviae*, how to prevent spread of the diseases and what to do when a suspected outbreak occurs.

WHY?:

- Well-trained production or sales area staff are crucial to the early recognition of *Phytophthora* outbreaks, since they will be working most closely with the plants. They also need to know the procedures to follow when a suspected case occurs
- Training in the correct hygiene and husbandry techniques will help to prevent inadvertent spread of these diseases by staff

HOW?:

All staff working with susceptible host plants, and those dealing with enquiries from the public (e.g. on an information desk in a garden centre) should be given training in, or be made aware of, the following aspects of *Phytophthora* diseases:

- Common host plants and symptoms [Defra / Fera *P. ramorum* host list](#) [Defra / Fera *P. kernoviae* host list](#)
- How to prevent the spread of disease by use of appropriate hygiene and husbandry techniques [See [NR&L7 on Hygiene](#) and [NR&L6 on Husbandry](#)]
- What to do if a suspected case of *Phytophthora ramorum* or *P. kernoviae* is found on the site (this may simply entail the provision of contact details for more senior staff to whom the finding should be reported) [See [NR&L13 on Outbreak situations](#)]
- The likely action (e.g. Statutory Notice) that will be taken if an outbreak of *P. ramorum* or *P. kernoviae* is confirmed, and how this is to be communicated and managed within the business
- How to deal with enquiries from the public (retail sites) [See [NR&L11 on visitors](#)]

The method used should be decided on a case-by-case basis, and may range from the simple provision of letters/emails and leaflets on the subject, to group training sessions led by another staff member with previous training or knowledge, or an outside specialist. [See [NR&L15 – Information sources](#)] Training records for individual staff should state the level of training received and the date that the training occurred. Regular updates or refresher training should also be given.

Members of staff designated more specific roles in relation to the prevention/control/reporting of these diseases should be given more-detailed training, including the provision of appropriate best practice protocols for their role. Such roles might include:

- Sourcing of plants [See [NR&L1](#) on Sourcing plants]
- Handling of plants on receipt [See [NR&L2](#) on Handling plants on arrival]
- Management of a plant quarantine area [See [NR&L3](#) on Quarantine areas]
- Risk assessment and surveillance [See [NR&L5](#) on Risk assessment and monitoring]
- Application of Plant Passporting procedures [See [NR&L14](#) on Plant passports]
- Reporting of suspected outbreaks of *Phytophthora ramorum* / *P. kernoviae* to the relevant Plant Health Authority [See [NR&L13](#) on Outbreak situations]
- Implementation of control measures under a Statutory Notice
- Dealing with press enquiries

NR&L11 CUSTOMERS AND VISITORS

[See [NR&L12](#) on On-site contractors]

AIM:

- To inform customers of garden centres and retail nurseries about the threat posed to ecosystems and gardens by pathogens such as *Phytophthora ramorum* and *P. kernoviae*
- To prevent the spread of these and other pests and diseases within and between nurseries by visitors to production sites

WHY?:

- *Phytophthora ramorum* and *P. kernoviae* (as well as many other pests and diseases, including root-infecting *Phytophthora* species) can be spread all too easily on footwear, tyres, etc. contaminated by infested soil or plant debris
- Informing (but not unduly alarming!) customers of garden centres and retail nurseries about the threat posed by these pathogens, and the symptoms that they cause, should lead to increased vigilance and the monitoring of a greater area (e.g. private gardens) than would be possible by the Plant Health Authorities alone

HOW?:

- Garden centres and nurseries with retail areas should consider the provision of information for customers on *Phytophthora ramorum* and *P. kernoviae* (and possibly some of the other pests and diseases that pose a threat to parks and gardens). This could take the form of leaflets or posters, located at places such as information desks or tearooms, but should not be overdone – a large display featuring many different pests and diseases could create alarm! [Fera general information](#)
~ [Phytophthora – Don't Let It Destroy Our Environment](#)
- Informing customers of the steps taken on the nursery or garden centre to minimise risk, and stating that all relevant legislation (e.g. Plant Passporting requirements) has been complied with, will help to increase consumer confidence in your product
- Ensure that visitors to sites of production on nurseries are aware of the potential for the spread of pests and diseases on contaminated footwear, vehicles or equipment. A brief but prominent notice to this effect could be displayed at the entrance to the nursery, or in the front office or signing-in area
- If it is considered appropriate, direct visitors to an area where footwear, etc. can be washed and/or disinfected before they enter or leave a production area
- Ensure that quarantine areas for bought-in stock are well signposted to prevent visitors from entering them

NR&L12 ON-SITE CONTRACTORS

AIM:

- To prevent the inadvertent spread by contractors of *Phytophthora* species (and other pests and diseases) around and between nurseries or retail sites

WHY?:

- Many pests and pathogens, including *Phytophthora* species, can be transferred around and between sites on footwear, tools, machinery or vehicles contaminated with infested soil and/or plant debris

HOW?:

Certain contractors, such as builders or utilities services, may only visit specific and localised parts of a nursery or garden centre during their work. However, they should still be made aware of the risks of spreading plant pests and diseases if:

- Their work will entail the movement or disposal of any soil or plant material
- They have been working previously at a site where there is a risk of contamination of tools or vehicles by infested soil or plant debris – if there is any doubt, their equipment should be cleaned before coming on-site
- Their vehicles or tools are likely to become contaminated with soil or plant debris when they are gaining access to, or are at, the location on the site where they are working

Other contractors (e.g. horticultural advisors, trade representatives from growing media, pesticide or biological control suppliers, engineers installing or maintaining facilities such as irrigation or crop lighting systems) are likely to require more extensive access to the site, and will have closer contact with the plants. The risk here is greater, and they will require more detailed guidance and checks, as listed below:

General guidance

- Before engaging contractors who will have extensive access to the site and/or its plants, ensure that they are aware of their responsibilities with regard to preventing the spread of pests and diseases around and between sites. Ask whether they have any existing written procedures in place to deal with this – if so, ask to see copies
- If the contractors do not have their own, satisfactory protocols, provide them with a copy of this best-practice protocol and, if relevant to their work, the protocols on husbandry ([NR&L6](#)), hygiene ([NR&L7](#)) and disposal of plant waste ([NR&L9](#)), for guidance
- As a general requirement, contractors should ensure that their footwear, vehicles and equipment are free from potentially infested soil or plant debris before they enter or leave the site. Clean footwear is particularly important if their work (e.g. that of

horticultural advisors or trade reps) involves routinely visiting and walking round other nurseries. Any plant material, soil or compost that has been sampled from other nurseries should be left in their vehicle in a sealed container. Tools used for such sampling should have been cleaned and disinfected

- Ensure that quarantine areas for bought-in stock are well signposted to prevent contractors from entering them without permission

Specific guidance for on-going pest or disease outbreaks

- Where there is a significant outbreak on the nursery of a pest or disease that could be spread by contractors working with or in proximity to the plants, the risk is obviously higher (particularly if a notifiable pathogen such as *Phytophthora ramorum* or *P. kernoviae* is involved)
- Ensure that contractors are made aware, before entering the site or the affected area, of the presence of the pest or disease
- Ask them if they are aware of the symptoms of the problem and the methods by which it spreads – if necessary provide them with relevant information, or information sources. [\[See NR&L15 on Information sources\]](#) Don't assume that advisors and trade reps will be aware of all significant pest and disease problems – they may be specialists only in certain aspects of crop production. Ask them to liaise with you regarding any suspicious symptoms that they may come across during the course of their work or visit, particularly if these are in areas currently thought to be unaffected
- Where a notifiable pathogen such as *P. ramorum* or *P. kernoviae* is involved, provide the contractor with all necessary details to allow them to work without risk of spreading the organism, and to comply with any requirements that have been issued as part of a Statutory Notice by the relevant Plant Health Authority. Such details would include:
 - ~ The locations of affected areas and any specific restrictions on access
 - ~ Relevant hygiene measures, including the disposal of waste material and the cleaning and disinfection of footwear, tools, machinery, etc. before leaving either the affected areas or the site as a whole

NR&L13 *PHYTOPHTHORA RAMORUM* / *P. KERNOVIAE* – OUTBREAK SITUATIONS

AIM:

- To reduce the impact of an outbreak by prompt detection, reporting and action

WHY?:

- An outbreak of *Phytophthora ramorum* or *P. kernoviae* on a nursery or retail site can have significant implications, both financially (through the destruction of diseased and associated plants) and by its effects on the day-to-day running of the site (as other plants are held under Statutory Notice, and measures have to be taken to contain and eradicate the problem)
- Diseased plants could be sold on to other nurseries, retail sites or members of the public, spreading the problem and adversely affecting the reputation of the supplier
- There are also wider threats to the natural environment (e.g. beech woodland, heathland) when action is not taken promptly
- Detecting the outbreak as soon as possible, and reporting it quickly to the relevant Plant Health Authority, can help to minimise these effects. If accurate records have been kept they should also enable the Plant Health Authority to trace the source of the outbreak back through the supply chain

HOW?:

Whilst it should help to reduce the risk, following the guidance in these *Phytophthora* best-practice protocols does not, unfortunately, guarantee freedom from an outbreak of *Phytophthora ramorum* or *P. kernoviae*. Therefore, this protocol deals with the procedures to follow in the event of a suspected outbreak, and the action that is likely to be taken when the presence of one of these notifiable pathogens is confirmed.

Suspected outbreaks

Regular monitoring of the site, and the use of a quarantine area for bought-in plants, should increase the chances that any outbreak is detected before it has the opportunity to progress too far. [See [NRL5 on Risk assessment and monitoring](#) and [NR&L3 on Quarantine areas](#)] If you find symptoms that you believe could be caused by *P. ramorum* or *P. kernoviae*:

- Notify the relevant Plant Health Authority immediately – this is a legal requirement [See [NR&L15 on Information sources](#)]
- Do not handle or move the plants elsewhere
- Inspect all other susceptible plants for symptoms and keep them under observation Include the perimeter of the site where it has susceptible trees or likely 'wild' hosts such as *Rhododendron ponticum* or *Viburnum* species

- Do not apply anti-*Phytophthora* fungicides. These are likely to suppress (rather than kill) the *Phytophthora* and could seriously compromise the management of the disease
- Restrict (or, where practical, stop) the use of overhead watering on plants thought to be affected
- Obtain and provide the Plant Health Authority with all necessary documentation and records, including supplier details, cultural history and plant passport information

Confirmed outbreaks

The Plant Health Authority staff will take samples from affected plants to be tested for the presence of *P. ramorum* and *P. kernoviae*. Where either is confirmed, a Statutory Notice will be issued detailing the eradication and containment actions required. The Statutory Notice will give a time frame in which the actions below must be carried out:

- All affected plants, and known hosts within a two metre radius of them, must be destroyed (usually by burning or by deep burial at an approved landfill site). Associated containers (pots, trays, etc.) must also be destroyed
- Growing media that has been used with the affected plants may be contaminated and should be destroyed
- For container-grown plants, the bed or bench surface on which the plants were standing should be disinfected
- All known natural hosts within a ten metre radius of affected plants will be held under the Statutory Notice and cannot be moved for at least three months
- These plants will be inspected at least twice by the Plant Health Authority during the period of the Notice. If no further infection is found the Notice will be lifted and the plants can be moved or sold
- If further infection is found during this time, there will be another three months holding period after the affected plants are destroyed. If the new findings are close to the edge of the previous ten metre quarantine area then the area will be increased in size (so that there is also a ten metre radius around the new findings)
- No anti-*Phytophthora* fungicides are permitted on plants being held under the Statutory Notice
- Use of overhead irrigation should be stopped or minimised during the holding period stipulated by the Notice

With field-grown nursery stock, the Notice may also specify measures to prevent re-infection of the site. These measures may include:

- Not planting susceptible plants within a four metre radius around an infected plant for three years

- Removal and deep burial of soil (to half a metre depth from a four metre radius around an infected plant)
- Steam or chemical treatment of the soil may be attempted as an alternative to removal

All staff should be made aware of the outbreak, what is required to deal with it, their role in this, and how information regarding management of the outbreak is to be communicated (both between the Plant Health Authority and the organisation, and within the organisation itself). It is important that this includes not only full-time employees, but also part-time staff.

NR&L14 PLANT PASSPORTS

AIM:

- To prevent the movement of plant material affected by *Phytophthora ramorum* into and within the European Union (EU). (N.B. Plant passporting criteria are also applied to hosts of a range of other quarantine [notifiable] organisms)

WHY?:

- Certain plant genera are 'key' hosts for *Phytophthora ramorum*. Most of the confirmed cases of the pathogen moving within the nursery trade have been found on these hosts. The pathogen is also capable of producing large numbers of spores on the foliage of some of these hosts, increasing the risk of the infection spreading widely
- Plant passports enable checks to be made for *P. ramorum* at the place of production. They are also critical in enabling the Plant Health Authorities to trace the source of any outbreaks of the pathogen back through the supply chain

HOW?:

General information on plant passports

- Certain plants moving within and between EU states require a plant passport
- The passport must always accompany the plant (at all stages of production down to the final retailer) and must include the words 'EC Plant Passport', a country identifier (e.g. UK/EW for the United Kingdom) and a reference number
- The reference number may include RP if the plants have a replacement passport. For example, if a trader has split or mixed a batch of plants for onward movement or sale, and that batch of plants already possessed a passport, a further passport is required for onward movement of the new batches
- The passport is issued by the plant producer, who is authorised and inspected by the relevant Plant Health Authority. The producer must re-apply for authorisation each year

The plant passport provides documentary evidence that:

- The plants have been grown by a registered grower whose premises are regularly inspected and who is authorised to issue plant passports
- The plants are, to the best of the producer's knowledge, free from all quarantine pests and diseases and, where appropriate, grown in an environment which is also free from pests and diseases
- Plants imported from outside the EU have been landed by a registered importer, inspected on arrival in the UK or in another member state (or at an approved destination)

and found to be free from quarantine pests and diseases prior to being passported for movement within the EU

Specific information on plant passports for hosts of *Phytophthora ramorum*

- The following genera of plants require plant passports in relation to *Phytophthora ramorum*: species and hybrids of *Camellia*, *Rhododendron* (except *R. simsii* (pot azalea)), *Viburnum*
- The conditions of the passport are that the material originates in areas where *P. ramorum* is not known to occur, or where there have been no signs of the pathogen at the place of production
- In cases where signs of the pathogens have been found, appropriate procedures for eradication must have been implemented

If you are in receipt of any of the above genera of plants, they must be accompanied by a plant passport.

- Inform the relevant Plant Health Authority if any of the above genera are delivered without a plant passport, or if the passport appears irregular or invalid
- Retain any plant passports for at least one year (this enables the Plant Health Authority to trace back any outbreaks)
- The Plant Health Authority can ask to see original passports – photocopies or retrospective plant passports are not acceptable. However, where it is not practical to keep the original document (e.g. it takes the form of a label stuck firmly to a plant tray), the passporting information may be copied onto a manual or computer log, provided that this is easily accessible for inspection

Further information on plant passports is given in the Defra document *Plant Health Guide to Plant Passporting and Marketing Requirements*, which can be downloaded from: [Plant Passport](#).

NR&L15 INFORMATION SOURCES FOR *PHYTOPHTHORA RAMORUM* & *P. KERNOVIAE*

1. PUBLICATIONS

***Phytophthora ramorum*: A Practical Guide for Established Parks & Gardens, Amenity Landscape and Woodland Areas (product code PB12983)**

***Phytophthora ramorum*: A threat to our woodlands, heathlands and historic gardens**

***Phytophthora kernoviae*: A threat to our woodlands, heathlands and historic gardens**

***Phytophthora*: Don't let it destroy our environment**

These guides from the Department of Environment, Food and Rural Affairs (Defra) and The Food and Environment Research Agency (Fera) give information on the background to the problem, the biology of the pathogen, a guide to minimising the risk, and steps to take if an outbreak is suspected. There are also descriptions and photographs of the symptoms caused on several host plants.

Copies can be obtained from:

The Food and Environment Research Agency
Sand Hutton
York
YO41 1LZ

Tel: +44 (0)1904 462000
Email: info@fera.gsi.gov.uk

2. WEBSITES

The Food and Environment Research Agency (Fera) – an executive agency of Defra.

The links below will take you to a front page for each of the pathogens. From here, there are further links to:

Distribution maps
The relevant Plant Health Order
Plant disease factsheets
Host lists
UK and EU Pest Risk Analyses (PRAs)
Key findings from UK research
Online versions of the 'Practical Guides' for *P. ramorum*, as listed under Publications, above.
Frequently asked questions

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/pRamorum/>

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/pKernoviae/>

Forestry Commission

This site concentrates on the threat to trees and woodland in the UK. The links below will take you to a front page for each of the pathogens. From here, there are further links to:

- Background and frequently asked questions
- Support for owners and managers
- Country briefings
- Symptom images
- Advice to owners and operators
- Information for agents
- Outbreak map
- Phytophthora* news releases
- Guidance for Plant Health Inspectors

<http://www.forestry.gov.uk/pramorurum>

<http://www.forestry.gov.uk/forestry/infd-66jlgb>

There are also links to the Forest Research arm of the Forestry Commission, the website of which contains further information.

Scottish Executive Environment & Rural Affairs Division (SEERAD)

This site provides information on the situation in Scotland. There are further links to information on:

- Legislation
- A practical guide
- Inspection and eradication
- Research
- Information sheets

<http://www.scotland.gov.uk/Topics/farmingrural/Agriculture/plant/PlantHealth/PlantDiseases/Phytophthoras>

Department of Agriculture and Rural Development, Northern Ireland (DARDNI)

This website provides information on the situation in Northern Ireland.

<http://www.dardni.gov.uk/forests/service/index.htm>

Risk Analysis for *Phytophthora ramorum* (project RAPRA)

This is the website of a risk analysis and research programme applying across and supported by the European Union. In addition to providing information on the work and objectives for the project, the website also includes useful general information such as European host lists, European disease distribution maps, photographs of symptoms and a life-cycle diagram.

<http://rapra.csl.gov.uk/>

Royal Horticultural Society (RHS)

This site provides information for gardeners and garden staff on the pathogens, and details of relevant RHS research.

<http://apps.rhs.org.uk/advicesearch/Profile.aspx?pid=329>

Information from the USA

The websites below may be useful for further information and pictures of symptoms, as well as showing the extent of the sudden oak death problem in parts of America (native UK oak species are more resistant to *Phytophthora ramorum* than their American counterparts).

United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service:

http://www.aphis.usda.gov/plant_health/plant_pest_info/pram/index.shtml

California Oak Mortality Task Force:

<http://www.suddenoakdeath.org/>

Oregon Department of Agriculture:

http://www.oregon.gov/ODA/CID/PLANT_HEALTH/sod_index.shtml

3. REPORTING OF SUSPECT FINDINGS OF *P. RAMORUM* OR *P. KERNOVIAE*

England and Wales

Notify the Plant Health and Seeds Inspectorate (PHSI), part of the Food and Environment Research Agency (Fera). Notify your local office, or Fera at York:

Plant Health
Room 10GA01
The Food and Environment Research Agency
Sand Hutton
YO41 1LZ
United Kingdom

Tel: +44 (0) 1904 465625

Fax: +44 (0) 1904 465628

Email: planthealth.info@fera.gsi.gov.uk

Details of local PHSI offices can be found at:

<http://www.fera.defra.gov.uk/contactUs/documents/phsiOffices0511.pdf>

Scotland

Notify the Scottish Government, Rural Payments and Inspections Directorate (RPID), Horticulture and Marketing Unit, Edinburgh:

Tel: +44 (0) 131 244 6303

Fax: +44 (0) 131 244 6449

Email: hort.marketing@scotland.gsi.gov.uk

Website: <http://www.scotland.gov.uk/Topics/farmingrural/Agriculture/plant/PlantHealth>

Northern Ireland

Notify DARDNI (Department of Agriculture and Rural Development Northern Ireland):

Quality Assurance Division
Department of Agriculture & Rural Development
Room 115
Magnet House
81–93 York Street
Belfast BT15 1AB

Tel: +44 (0) 28 9054 7106

Fax: +44 (0) 28 9054 7204

Suspected cases on trees should be reported to the Forest Service, Tel: +44 (0) 28 9052 4480.

Website: <http://www.dardni.gov.uk/plant-health-for-northern-ireland-title-page>

In **England, Wales** and **Scotland**, suspected cases on **mature trees and woodland** specifically should be notified to the Forestry Commission Plant Health Service:

Forestry Commission
Plant Health Service
Silvan House
231 Corstorphine Road
Edinburgh
EH12 7AT

Tel: +44 (0) 131 314 6414

Fax: +44 (0) 131 314 6148

Email: plant.health@forestry.gov.uk

4. DISPOSAL OF PLANT WASTE

The following organisation's websites carry information on the various methods available to dispose of or process plant waste, and/or the legislation that applies:

Environment Agency:

<http://www.environment-agency.gov.uk/business/sectors/32777.aspx>

Waste Resources Action Programme (WRAP):

<http://www.wrap.org.uk/>

Association for Organics Recycling (AfOR):

<http://www.organics-recycling.org.uk/category.php?category=991&name=Certification>

General guidance for the treatment of horticultural waste to minimise plant health risks is available in the Food and Environment Research Agency (Fera) document *Code of Practice for the Management of Agricultural and Horticultural Waste*:

<http://www.fera.defra.gov.uk/plants/publications/documents/copManagementWaste.pdf>

5. PLANT PASSPORTING INFORMATION

This is available on the Food and Environment Research Agency (Fera) website:

<http://www.fera.defra.gov.uk/plants/plantHealth/plantPassporting.cfm>

6. TESTING OF PLANTS, GROWING MEDIA, SOIL & WATER

The Fera Plant Clinic is able to test for a range of *Phytophthora* species, including *P. ramorum* and *P. kernoviae*:

<http://www.fera.defra.gov.uk/plants/plantClinic/>

Some other laboratories may also be able to test for *Phytophthora* spp.

7. ACCREDITATION SCHEMES FOR PRODUCERS OF ORNAMENTAL PLANTS

British Ornamental Plant Producers (BOPP):

<http://www.bopp.org.uk/index.html>

Linking Environment and Farming (LEAF):

<http://www.leafuk.org/leaf/home.eb>

GLOBALG.A.P. Flowers and Ornamentals Standard:

http://www.globalgap.org/cms/front_content.php?idart=143&idcat=48&lang=1&client=1

Each of these websites gives details of the aspects of production that are covered within the accreditation scheme, and the criteria examined during the independent auditing process. Some of the BOPP certification schemes also satisfy the criteria for LEAF and GLOBALG.A.P.

NR&L16 USE OF *PHYTOPHTHORA* LATERAL FLOW DEVICES (LFDs)

BACKGROUND

What are they?

LFDs use antibodies to detect antigens (proteins) using technology similar to that employed in home pregnancy testing kits. The antigens are produced by all species of *Phytophthora*, including *P. ramorum* and *P. kernoviae*.

How can they help us?

Symptoms of diseases caused by *Phytophthora* species can often be confused with other diseases, insect damage, over- or under-watering etc. In these situations, LFDs can be used to confirm if the symptoms are caused by a *Phytophthora* species. The devices have been used extensively to test for *Phytophthora* diseases both in gardens and in plant sales areas. LFDs are also available for a range of other fungal, bacterial and viral diseases.

How specific are they?

The kits are known to react to at least 13 species of *Phytophthora* including *P. ramorum*, *P. kernoviae*, *P. fragariae*, *P. cactorum* and *P. infestans*, so are useful for general *Phytophthora* screening. They do not cross-react with related organisms such as *Pythium* spp. or downy mildews.

How sensitive are they?

The kits are very sensitive and can detect just a few milligrams of infected rhododendron leaf tissue (equivalent to a few square millimetres, permitting detection in leaf tissue which is less than 1% infected by *P. ramorum*).

What can and can't I test?

Leaves, stems, roots can be tested, but the kits are not suitable for testing soil or water. They have been used successfully to test bleeding bark cankers.

Where can I buy them?

The kits are commercially available from Forsite Diagnostics Ltd, Sand Hutton, York YO41 1LZ

Tel: +44 (0) 1904 462660

Email: pocketdiagnostic@forsitediagnostics.com

Website: <http://www.forsitediagnostics.com>

INSTRUCTIONS FOR USE – EXAMPLE *P. ramorum/kernoviae*

In order to prevent any cross-contamination when breaking up the tissue prior to placing in the extraction bottle, either wear disposable gloves or wash hands with a proprietary alcohol gel between samples.

Leaves: Take approx. a 1–2 cm square of diseased tissue (Figure 1a). Fold up the piece of tissue and crush to help break down the sample (Figure 2a).

Stems: Shave-off about 5 small (ca. 1 cm long) slivers of the outer tissue from a necrotic area. Try to get tissue from the leading edge of infection (the boundary between brown and green) because the fungus is most active there. Crush if possible (Figures 1b and 2b). Clean knife before re-use.

Place the sample in the extraction bottle (Figure 3a) and shake vigorously for at 60 seconds (Figure 3b). Longer may be needed for woody tissue.

With the pipette, draw up the extraction solution (there should be a slight green to brown coloration if the extraction has been successful, Figure 4a).

Place 2–3 drops in the sample well (Figure 4b). If liquid does not start to flow across the membrane after 30 seconds (Figure 5a), add one or two further drops until fluid flows across the membrane. Do not use more than 4 drops as this will flood the membrane resulting in an invalid test.

Leave for 2–3 minutes.

Check to see whether a blue line has appeared at 'C' (control), (Figures 6a and 6b)

Check to see whether a blue line has appeared at 'T' (test), (Figures 6a and 6b)

You may check for lines up to 20 minutes, but results after this time should not be considered.

In cold weather, the devices may take longer to develop. If the kits are very cold (e.g. stored in a car overnight), it is advisable to bring them back up to room temperature.

If the material appears dry or is very woody after the initial 60 seconds of shaking you can leave the sample in the bottle to soak to aid extraction for up to 1 hour before testing.

INTERPRETATION OF RESULTS

Control line is not blue – test invalid re-test with the same extract but a new LFD.

Control line is blue – test valid

Test line is blue within 10 minutes (Figure 6b – upper LFD [A]) – **Positive** for *Phytophthora* spp.

Test line is not blue within 20 minutes (Figure 6b – lower LFD [B]) – **Negative** for *Phytophthora* spp.

HEALTH & SAFETY

Risk to user: The extraction buffer contains sodium azide, a detergent (Tween 20) and polyvinylpyrrolidone (PVP). The concentrations are such that any risks associated with the product are considered very low. However, ingestion of the buffer should be avoided, and care should be taken to avoid contact with skin or eyes. Should contact occur, rinse with copious amounts of water.

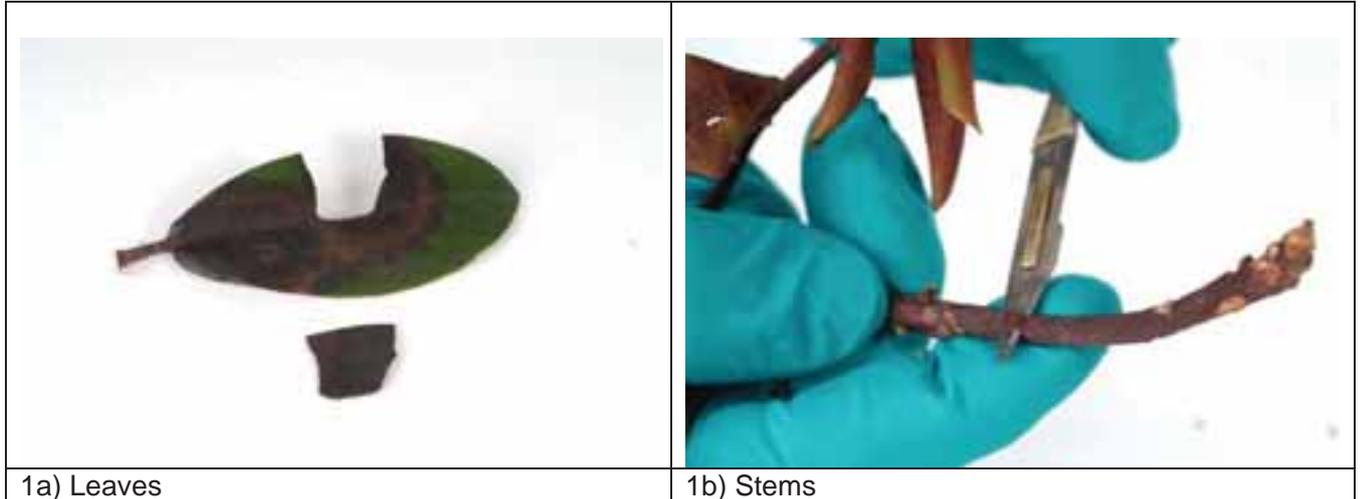
STORAGE

Store at ambient conditions. Do not place in the fridge or freezer. The kits have an expiry date

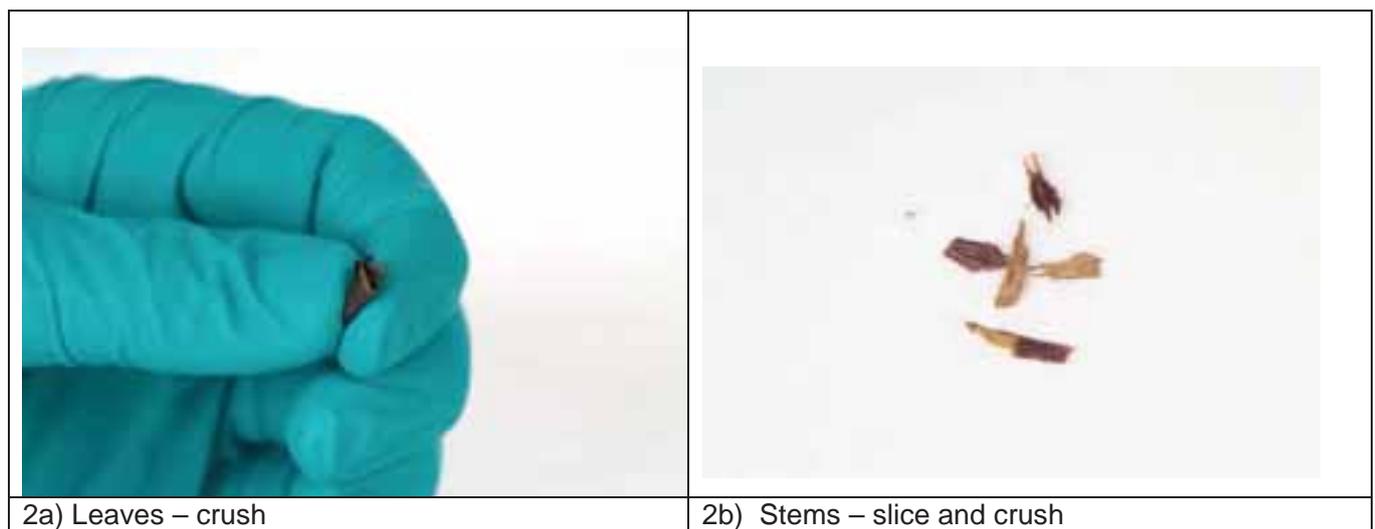
on the foil packet. Once the foil packet has been opened, use the kits as quickly as possible (within several days). Where possible, seal opened foils with sticky tape until remaining LFD is required.

SAMPLING AND TESTING PROCEDURE

Select a sample



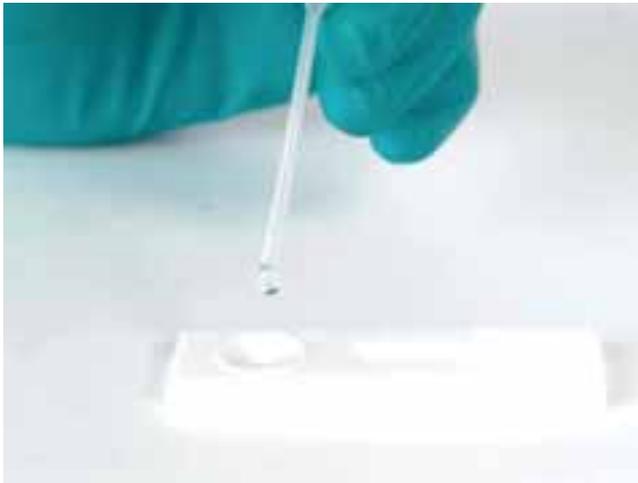
Break down sample prior to placing in the extraction bottle



Place sample in extraction bottle and shake vigorously for 60 seconds

	
3a) Place in bottle	3b) Shake vigorously for 60 seconds

Draw up extraction fluid and pipette onto LFD

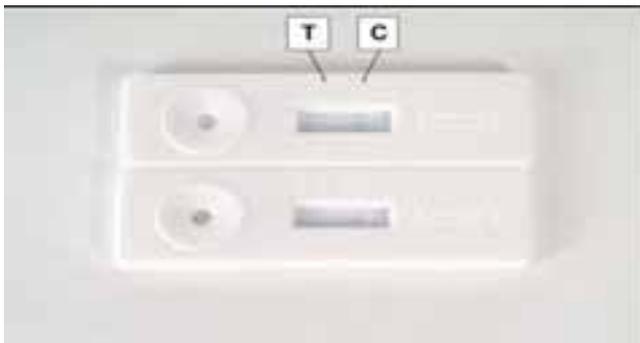
	
4a) Check to see if the extraction liquid is discoloured	4b) Pipette 2–3 drops onto sample well

Check to see if the extraction fluid is running across the membrane



5a) Pale blue fluid runs across membrane

Read after 2–5 minutes



6a) Test kit after 30 seconds – faint control lines ('C') appearing; no test lines ('T') appearing



6b) Test kit after 3 minutes: A) Test valid, sample negative; B) Test valid, sample positive

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Appendix 2

List of full URLs for hyperlinks

For printed versions the following are the full URLs for the links used within this document:

NR&L1 SOURCING PLANTS

Defra/Fera *P. ramorum* host list

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/documents/pRamorHost.pdf>

Defra/Fera *P. kernoviae* host list

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/documents/pKernoviaHost.pdf>

NR&L4 DESIGN & LAYOUT

Defra / Fera *P. ramorum* host list

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/documents/pRamorHost.pdf>

Defra/Fera *P. kernoviae* host list

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/documents/pKernoviaHost.pdf>

NR&L5 RISK ASSESSMENT AND MONITORING

FC *P. Ramorum* Distribution

<http://www.forestry.gov.uk/forestry/infd-86ajqa>

Fera *P. Ramorum* distribution

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/pRamorum/>

Fera *P. Kernoviae* distribution

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/pKernoviae/>

Defra / Fera *P. ramorum* host list

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/documents/pRamorHost.pdf>

Defra / Fera *P. kernoviae* host list

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/documents/pKernoviaHost.pdf>

Fera Information

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/>

FC information

<http://www.forestry.gov.uk/pramorum>

Forsite

<http://www.forsitediagnostics.com/>

NR&L6 HUSBANDRY

Liaison

<https://secure.fera.defra.gov.uk/liaison/>

NR&L9 DISPOSAL OF PLANT WASTE

Environment Agency 117109 (Exemption T23)

<http://www.environment-agency.gov.uk/business/sectors/117109.aspx>

Environment Agency 117226 (SR2010no14)

<http://www.environment-agency.gov.uk/business/topics/permitting/117226.aspx>

Organics

<http://www.organics-recycling.org.uk/category.php?category=991&name=Certification>

Environment Agency GEHO0610BSVC-E-E

http://www.environment-agency.gov.uk/static/documents/Business/Compost_Quality_Protocol_GEHO0610BSVC-E-E.pdf

Environment Agency 117125 (Exemption D6)

<http://www.environment-agency.gov.uk/business/sectors/117125.aspx>

Environment Agency 117127 (Exemption D7)

<http://www.environment-agency.gov.uk/business/topics/permitting/117127.aspx>

Waste Directory

<http://www.wastedirectory.org.uk/>

Environment Agency 89988

<http://www.environment-agency.gov.uk/business/regulation/89988.aspx>

Code of Practice

<http://www.fera.defra.gov.uk/plants/publications/documents/copManagementWaste.pdf>

NR&L10 STAFF TRAINING

Defra / Fera *P. ramorum* host list

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/documents/pRamorHost.pdf>

Defra / Fera *P. kernoviae* host list

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/documents/pKernoviaHost.pdf>

NR&L11 CUSTOMERS AND VISITORS

Fera general information

<http://www.fera.defra.gov.uk/plants/plantHealth/pestsDiseases/phytophthora/>

Phytophthora – Don't Let It Destroy Our Environment

<http://www.fera.defra.gov.uk/plants/publications/documents/phytophthoraPublicLeaflet.pdf>

NR&L14 PLANT PASSPORTS

Plant Passports

<http://www.fera.defra.gov.uk/plants/publications/documents/pass.pdf>

BIOSECURITY POSTER FOR NURSERIES AND GARDEN CENTRES

TURNING OVER A CLEAN LEAF

How to protect your nursery or garden centre from pest and disease invaders

- 1 Plants coming in** is the main method by which many pests and diseases move between premises!

What can you do?

 - Source plants from suppliers with a good record of supplying disease-free stock
 - Check whether your supplier belongs to an official accreditation scheme
 - Nurseries - if possible, propagate from your own stock plants

2 Plants on arrival need careful inspection.

Remember to:

 - Check for compliance with purchase order and any plant passport or phytosanitary certificate required
 - Keep accurate records of all bought-in material
 - Only accept delivery if you are sure that the plants are healthy
 - If there are any problems, inform your supplier immediately
- 3 Quarantine areas** should be isolated from production and retail areas.

What more can you do?

 - Restrict access to the area
 - Be scrupulous about hygiene
 - Use dedicated tools
 - Hold new arrivals for an appropriate period and monitor frequently
- 4 Clear information** helps keep customers and visitors informed and aware. **How can this be done?**

 - Display a notice to site visitors about the risks of introducing pests or diseases
 - Clearly identify quarantine areas to prevent visitors entering
 - Increase consumer confidence by informing them of the methods used to minimise pest and disease risk
 - Consider providing information on pests and diseases, e.g. at help desks.
- 5 Day-to-day hygiene:** it's all too easy to spread pests and diseases through poor hygiene!

It's important to:

 - Regularly clean and disinfect tools, machinery, clothes and boots
 - Protect hands from contamination
 - Use new pots and trays wherever possible
 - Cover items (e.g. pots, compost storage areas) that could be contaminated by plants or soil debris
 - Have regular 'clean-ups' of standing areas
 - Bag up pest or disease-affected plants before removal
 - Cover steps & other disposal areas and locate them downwind from production/retail areas
 - Practice scrupulous hygiene in propagation areas

- 6 Good plant husbandry** also matters.

What can you do?

 - Avoid plant stress caused by nutrient deficiency or under/over watering
 - Handle plants with care at all times
 - Avoid prolonged leaf wetness or very high humidity:
 - Use sub-irrigation if possible
 - Don't overwater irrigate late in the day
 - Visit glass greenhouses & polytunnels
 - Space plants well
 - Protect aerial parts from soil or compost splash
- 7 Good water management** should help to prevent the spread of plant pathogens, such as Phytophthora species.

How can this be done?

 - Recycled water should be treated before use
 - Regularly test recycled water for pathogens
 - Cover water storage tanks
 - Regularly clean and disinfect storage tanks & irrigation lines
 - Keep paths & standing areas in good order to prevent puddles forming
 - Improve drainage of soil-grown crops where waterlogging is a problem
- 8 Organic waste** can harbour pests and pathogens.

What should be done with it?

 - All dead plants, prunings, etc., must be collected and disposed of safely
 - Options for disposal include:
 - Composting according to FERA's Code of Practice for Horticultural Waste
 - Anaerobic digestion
 - Landfill
 - Burning
 - Ensure that you are fully aware of the regulations surrounding waste disposal and treatment
- 9 Regular monitoring** helps you spot problems early and take prompt remedial action. **What can you do?**

 - Use trained staff to monitor stock at regular intervals for pests and diseases
 - Get any unknown problems identified
 - Include the site boundaries (e.g. hedgerows) in the monitoring schedule
 - Actively suspect findings of quarantine pests or diseases to the relevant plant health authority



Illustration by Sarah J. Newman and Christopher S. Tuckwell

