

Asparagus

Project No. FV 246

Management of *Phytophthora* rot on UK asparagus crops

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Symptoms of *Phytophthora* on asparagus were widespread in the UK for the first time in 2002. The disease is known to be a major production constraint in New Zealand and California, USA, where yield losses of 50% have been reported. This factsheet alerts growers to the problem, and summarises available knowledge of the disease and potential management strategies.

Background

Before 2002, reports of *Phytophthora* rot on asparagus in the UK were rare. In 2002, however, disease symptoms were widespread, with results from a grower questionnaire indicating that at least 50% of the asparagus production area in the UK may be affected or at risk from the disease. Up until 2004, there were no fungicides approved for the control of *Phytophthora* on asparagus either in the UK or the rest of Europe. Given the perennial nature of the crop and that *Phytophthora* is soil-borne, there were concerns that without the

option for chemical control, the disease could become a major production constraint. A specific off-label approval for use of SL567A (metalaxyl-M) on UK asparagus is now available.

Phytophthora rot is an important disease in New Zealand, USA, Mexico, Chile and Australia. In Europe, *Phytophthora* is an occasional problem on green asparagus in France, Spain and Italy. The disease is endemic in the Netherlands and Germany but does not pose a major threat in these countries because of different cultivation practices used to produce white asparagus.

The majority of research on the biology and control of the disease has been carried out in New Zealand and USA (California) where yield losses in excess of 50% have been attributed to *Phytophthora*. Losses are due to failure of newly planted crops to become established and from reduced yields or plant death in mature crops. Infected spears, if hydro-cooled during packing for market, may contaminate the water and spread the pathogen to other spears, causing extensive rotting during transit.

Symptoms

The disease is characterised by slightly sunken, water-soaked lesions

on shoots at, slightly above, or below the soil level (spear rot) (Fig 1). Under wet conditions, the lesions become slimy because of secondary invasion

by bacteria, and may have a disagreeable odour. Spears usually have a crooked appearance with lesions on the inside of the crook



1 Watersoaked lesion due to *Phytophthora* on harvested asparagus spear

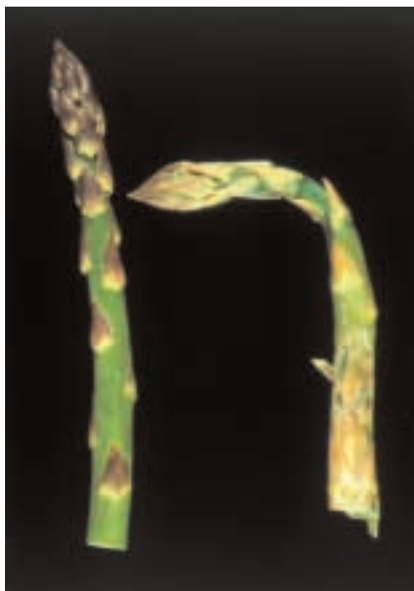


Photo appears courtesy of Dr P. Falloon, Aspara Pacific Ltd, New Zealand

2 'Crooked' spear (right) resulting from *Phytophthora* infection



Photo appears courtesy of Dr P. Falloon, Aspara Pacific Ltd, New Zealand

3 Field view of 'crooked' spear (centre) due to *Phytophthora*

(Figs 2 and 3). This symptom is not, however, diagnostic because insect, slug and mechanical injury can also result in crooked spears. Asparagus samples with suspected symptoms of *Phytophthora* can be sent to a diagnostic laboratory for testing. Under dry conditions, the whole lesion may become light brown and the spear may finally shrivel up (Fig 4).

Newly formed storage roots infected with *Phytophthora* appear white but slightly transparent. Fleshy storage roots of infected plants may be reddish-brown and occasionally hollow. Infected crowns have yellow-brown coloured tissue, which may appear water-soaked and fibrous.



4 Dried shrivelled spears resulting from *Phytophthora* infection

Biology of the disease

The *Phytophthora* species of greatest importance on asparagus in New Zealand and California is *P. megasperma* var. *sojajae*. A number of other *Phytophthora* species are reported to infect asparagus and all of them have a wide host range. However, some of these species may include specialised 'biotypes' that are pathogenic only to asparagus. The species of *Phytophthora* infecting UK asparagus has not been fully diagnosed as yet, although a laboratory report from 2001 suggests that *P. megasperma* may be implicated.

Phytophthora species are soil-borne fungi and can survive in the soil for long periods of time as thick-walled spores. When environmental conditions are favourable, particularly in the presence of free water, mobile spores are released which can infect plant tissues.

As with *Phytophthora* diseases on other crops, disease development is most severe following heavy rains and in poorly drained soil. However, infection occurring during the winter when the plant tissue is dormant is thought to have relatively little effect on production compared with infection in spring, which can lead to the development of substantial spear and crown rot.

From UK observations in 2002, diseased plants were not confined to

a specific area of the field but were distributed throughout the crop. Rate of disease spread within an individual field is likely to depend on drainage and water movement.

Sources of inoculum for the disease include planting material (crowns, transplants) and infested soil. At present, planting material is not tested specifically for *Phytophthora* infection. However, asparagus planting material that is certified to be of high quality, originating from the Netherlands and France is inspected in the field during plant production to ensure that there are no disease symptoms (see details in 'Cultural practices' section below).

Disease management

Cultural practices

Due to the ability of the pathogen to survive in soil and the perennial nature of asparagus, it is difficult to eliminate the disease once it is present in a crop. Avoidance is the best management strategy:

- Avoid planting new fields where there have been severe problems with *Phytophthora* on a previous crop. Even if symptoms were not due to a *Phytophthora* species pathogenic on asparagus, presence of the disease on a previous crop indicates that soil conditions may be conducive for development of *Phytophthora* in that field.
- Ensure that soil is well-drained and not prone to water-logging. If there is poor drainage in a mature crop, take action to remedy the problem.
- Obtain planting material from reliable suppliers. In the Netherlands, asparagus planting material with the Select Plant[®] label is certified by the Netherlands Inspection Service for Horticulture (Naktuinbouw). A list of Select Plant suppliers[®] can be obtained from the following website: www.naktuinbouw.com. A similar scheme is available in France.
- Transplanting or planting of crowns should be carried out under dry, warm conditions, to minimise the risk of *Phytophthora* infection.
- If *Phytophthora* rot has been observed in one asparagus field, wash down machinery between operations in different fields, to minimise soil spread.

- Spears found with *Phytophthora* rot in the packhouse should be discarded, ensuring that waste is not returned to cropped areas.

Chemical control

The newer formulation of metalaxyl (metalaxyl-M, marketed as Ridomil Gold by Syngenta) is used in California and New Zealand for the control of asparagus *Phytophthora*. The equivalent product in the UK, SL567A, now has off-label approval for use on asparagus (SOLA 0611/2004, Table 1). Use of this product may be warranted on fields where symptoms of *Phytophthora* have been observed on asparagus spears in previous harvest seasons.

The fungicide may be applied once per season to soil in spring-time, prior to spear emergence. The label for use of metalaxyl-M on asparagus in the USA recommends application 30-60 days before anticipated first harvest, so that there is opportunity for control of *Phytophthora* prior to spear emergence. Ensure that the soil is free of weeds and trash.

Apply the fungicide in sufficient water to obtain good soil coverage (minimum of 200 litres water/ha). The fungicide is unlikely to penetrate deeply into the soil unless very high water volumes are used, which may be impractical. SL567A should be most effective when applied to moist soils and then 'washed' into the soil with an advancing front of water from rain or irrigation. The product should not be applied to wet saturated soil as it is readily removed from the soil by surface drainage, due to the high solubility of the compound. There is a possibility of ground water contamination where soils are permeable and the water table is shallow. The product may be less effective on soils with a high organic matter content.

Pathogen resistance

There are concerns about the development of resistance to metalaxyl in *Phytophthora* populations, particularly after repeated use of the fungicide over several years. On asparagus, metalaxyl is used to control soil-inhabiting fungi rather than foliar species of *Phytophthora* (e.g. potato late blight), for which the risk of rapid resistance development is higher. However, to minimise the risk of fungicide resistance to metalaxyl:

- The fungicide should be applied across the entire soil surface. Avoid band-spraying the product just to the top of the asparagus beds as this leads to a dilution effect at the edge of the spray band.
- Adhere to the recommended dose rate on the off-label approval.
- Only one spray application is permitted per season and this must be applied only to soil.

Microbial degradation

Metalaxyl degrades in soil due to the activity of soil micro-organisms. The rate of degradation varies greatly but can reduce the efficacy of the fungicide. Established asparagus crops are unlikely to be high risk for microbial degradation of metalaxyl unless there has been a history of metalaxyl use on other crops (e.g. potatoes and vegetables). A soil test is available at Warwick HRI, Wellesbourne (www2.hri.ac.uk) to determine metalaxyl degradation rate. This test may be warranted prior to metalaxyl use in established crops and perhaps more importantly in new asparagus plantations, if there is history of metalaxyl use on previous crops.

Table 1 – Use of SL567A on asparagus

Product	Active ingredient	Product application rate	Timing	Water volume	Harvest interval
SL567A (Syngenta) SOLA 0611/2004	Metalaxyl-M	1.3 l/ha	One application per year, prior to spear emergence	Minimum of 200 litres water/ha	7 days

Note – Application to be made using a tractor mounted sprayer

Alternative management strategies

After 10–15 years repeated use of metalaxyl on asparagus in New Zealand and California, and associated problems of pathogen resistance and/or microbial degradation, alternative management strategies for the future have received attention:

- No cultivars of asparagus are resistant to *Phytophthora*. However, a breeding programme in New Zealand has produced several hybrids that have multi-gene resistance to *Phytophthora*. This type of resistance is less likely to be overcome by changes in the pathogen population than single gene resistance. In New Zealand, the hybrids show yield and quality traits

equal to, or better than the standard cultivars UC157 and JWC1.

- Results from preliminary field trials in New Zealand show that inoculation of asparagus crowns with a biological control agent, *Pseudomonas aureofaciens*, led to a significant increase in the yield of fern dry weight in comparison to untreated plants.
- In California, Aliette (fosetyl-aluminium) is approved for the control of *Phytophthora* on asparagus. The fungicide is applied to the previous years' fern crop. Potassium phosphite is also approved as a fungicide (Phostrol)

in some states of the USA for *Phytophthora* control and may be trialled in California for use on asparagus.

- In New Zealand, treatment of crowns with metalaxyl prior to planting can improve establishment rate.

Action points

- Ensure that there is good drainage at new sites and in mature stands.
- Use certified planting material.
- Infected spears seen in the packhouse should be removed prior to packing.

- If symptoms of *Phytophthora* were observed on asparagus spears in the previous harvesting season, an application of SL567A (metalaxyl-M) prior to spear emergence may be warranted.

Always read and follow the Off-label approval notice

Note

Regular changes occur in the approval status of pesticides, arising from changes in pesticide legislation or for other reasons. For the most up to date information, please check with your professional supplier, BASIS registered adviser or with the Information Office at the Pesticides Safety Directorate (PSD) (Tel 01904; www.pesticides.gov.uk).