SoilWealth
NURTURING CROPS

Integrated Crop Protection
PROTECTING CROPS

APRIL 2020

Photo: Jordan Eggers, Oregon State University

# PINK ROT

## *Phytophthora erythroseptica*

## MANAGEMENT OPTIONS

- ✔ **Metalaxyl and Metalaxyl-M (mefenoxam) are effective, but Metalaxyl resistance* has been identified in the US where the active ingredient has been overused in the crop rotation. The resistance situation in Australia is unclear at the moment.**
- ✔ **Some cultivars are less susceptible than others but can get the disease to some extent.**
- ✔ **Avoid excessive soil moisture**.**
- ✔ **Avoid practices that lead to water logging such as compaction.**
- ✔ **Avoid soils that are compacted (> 2000 kPa with a penetrometer) consider introducing controlled traffic and/or minimum tillage into the rotation.**
- ✔ **Remove all volunteers and potential hosts from paddocks.**
- ✔ **Avoid mixing tubers from contaminated areas with other tubers during storage or better still avoid harvest of contaminated tubers.**
- ✔ **Practice good rotation.**

* Metalaxyl is a chemical which has been shown in certain soils to develop enhanced biodegradation. In other words, the soil microorganisms use it as a food source and thus it is rapidly degraded before it can be effective. This is more likely to occur with repeated usage on many crops.
** This is sometimes seen as conflicting with management for diseases such as common scab where a wetter soil is recommended. This is not necessarily the case. Soils should be kept moist (between field capacity [FC] and above wilting point but without excess moisture). If water drains from soil or can be squeezed out of soil it is above FC.

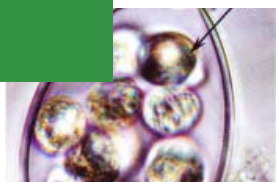
Hort Innovation
ahr applied horticultural research
RMCG

This project has been funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

PINK ROT
**April 2020**

SoilWealth NURTURING CROPS

Integrated Crop Protection PROTECTING CROPS



## THE PATHOGEN AND DISEASE

Pink rot of potato is an important soil-borne storage disease of potatoes worldwide. It is caused by the fungus *Phytophthora erythroseptica* and sometimes by *P. cryptogea*. Pink rot infection is often associated with secondary infection by anaerobic soft rot bacteria.

### *Phytophthora* isolates vary in harmfulness

- Infections vary in virulence
- Potato varieties vary in susceptibility
- It can survive for long periods in the soil
- Can be spread by symptomless tubers and also in water and rapidly in the right conditions – warm (20-30°C), wet soils (e.g. compacted areas)
- It infects all below ground parts of a plant
- In early infection stage it resembles blackleg
- A large number of host species occur including many weed species (see Table 1)
- High humidity along with poor ventilation can cause heavy losses of stored potatoes.

## POTENTIAL MANAGEMENT OPTIONS

**Biofumigants** such as mustards have been shown to be effective. Biofumigants should be used according to best practice advice.

A link between **low pH in the rootzone, low levels of free calcium in the soil solution and disease severity** has been observed. Disease incidence was greater below pH 5 and decreased above pH 7. **Liming and soil application of soluble calcium fertilisers may alleviate this risk** (by increasing the pH and the soluble calcium).

### RISK FACTORS SUMMARY

- Previous crop rotation that included hosts combined with host weed species being present (see Table 1)
- Seed with unknown health status
- Highest risk is when soil temperatures are 15 - 25°C

### Recommendations for R&D

- Develop a pink rot test and threshold in soil for incorporation into PreDicta Pt.
- Investigate the relationship between root zone pH, soluble soil calcium and disease incidence and severity.

## SYMPTOMS

Diseased plants are first observed in poorly drained parts of the field. Disease symptoms, mostly characterized by **stunting and wilting**, appear on the potato vines late in the growing season. **Wilting starts from the base of the stem and progresses upward, causing leaf yellowing, drying and defoliation**. Vascular discoloration and blackening of the underground stems may also be observed. Similarly, roots may turn brown to black, and occasionally aerial tubers may develop.

Symptoms on tubers are more obvious and characteristic of the disease. **Tuber decay begins at or near the stem** or stolon end of the tuber. **Infected tissue becomes rubbery** but not discolored in the early stages of infection, and when infected tubers are cut open, **the rotted portion is delimited by a dark line, visible through the tuber skin** (Fig. 1). The tuber skin (periderm) over the rotted portion is light brown in white-skinned cultivars.

Hort Innovation ahr applied horticultural research RMCG

This project has been funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

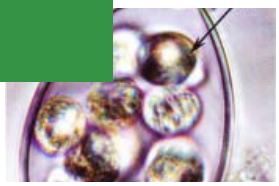



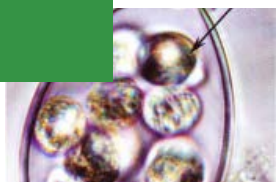

**Table 1 Known crop and weed hosts of pink rot** (Note - the absence of colour does not necessarily always denote that the plant is not a host. In many cases there is no evidence one way or the other.)

| Weed | Host for pink rot? | Weed | Host for pink rot? |
|---|---|---|---|
| Barley | yes | Pigweed | |
| Bindweed | | Quena | |
| Black or blackberry nightshade | yes | Selfsown potatoes | yes |
| Broad bean | yes | Shepherds purse | |
| Cape gooseberry | | Short term ryegrass | yes |
| Capsicum | | Skeleton week | |
| Carrot | yes | Spring vetch | yes |
| Cereal ryegrass | yes | Swedes/turnips | yes |
| Clover species | | Thornapple | |
| Fat hen | | Tomatoes | yes |
| Green beans | | Vetch | yes |
| Hairy/green nightshate | yes | Wheat | yes |
| Kale/cabbage | yes | Wild tomato | |
| Oats | yes | Wire weed | |
| Perrenial rye grass | yes | Yellow mustard | |
| Phalaris | | | |

Note: Presence of any of these plants presents a risk. All of the above plants are hosts of some soil borne disease in potatoes. If one disease is present in a plant it is more susceptible to other diseases.

Hort Innovation ahr applied horticultural research RMCG

This project has been funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.



Pink rot is not a slimy soft rot, and rotten tissues remain intact but spongy. When rotten tubers are cut open, the internal tissues are cream-colored and usually odourless. The tough, leathery, rubberlike texture of infected tubers distinguishes pink rot from bacterial rot disease in which the diseased tissue becomes soft and pulpy and contains numerous cavities.

However, **infected tissues are easily invaded by secondary pathogens**, such as soft rot bacteria (*Pectobacterium* spp.), which produce the slimly symptoms often found in potatoes with pink rot (Fig. 2).

**As tubers are exposed to the air, the colour of the infected tissue progressively changes from cream to salmon pink** within 15 to 30 minutes (Fig. 3). After about one hour, the tissue gradually turns brown and then black. If the cut tuber is squeezed, a clear liquid may ooze out of the cut surface.

## DISEASE CYCLE

*Phytophthora erythroseptica*, the causal agent of pink rot, is a soil-borne pathogen that produces thick-walled sexual spores called oospores that **can survive and persist in the soil for up to 7 years** (Fig. 4).

**Soil-borne oospores are the primary source of inoculum for pink rot in potato**. Transmission by infected seed tubers has always been considered of minor importance because rapid rotting and decay of tuber tissue during storage will exclude these tubers from being used as planting material. However, **the surface of healthy tubers may be contaminated with oospores that can be transferred to new locations**. Oospores formed in infected tubers that were missed during harvest (volunteer potatoes) or in cull piles will end up in the soil after deterioration of the tubers (Fig. 5).

**The pathogen can also be transferred to new fields in infected soils carried on farm machinery and bins.** Within an infested field, oospores are **likely to spread when soil is moved around during cultivation**.

**Figure 1. In the early stages of pink rot infection, the rotted portion of the tuber is delimited by a dark line.**

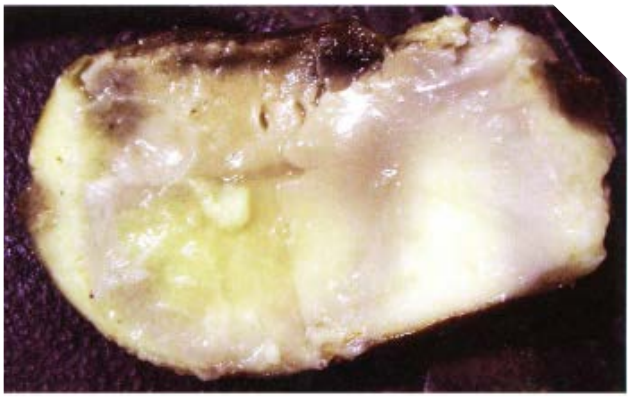


**Figure 2. Pink rot infection is usually followed by secondary infection by anaerobic soft rot bacteria. These turn the tuber tissue soft, creamy and mushy.**

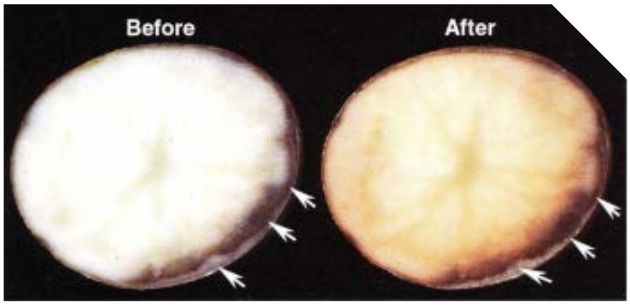
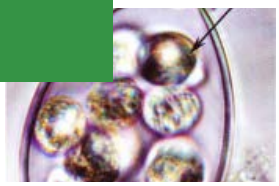



**Figure 3. Tubers infected with pink rot turn pink after exposure to air for 15 to 30 minutes. Arrows indicate diseased tissue.**

This project has been funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.


**Irrigation water** is also an important source of movement of the oospores from one location to another within a field and among nearby fields.

Pink rot may also spread from tuber to tuber in storage.

*Phytophthora erythroseptica* develops rapidly at soil temperatures from 10 to 30°C. However, **the optimal temperature for infection is 25°C**. The pathogen usually infects tubers through stems below soil level and stolons. **In warm, wet conditions, oospores of *P. erythroseptica* will germinate** and produce the asexual stage of the pathogen, which consists of mycelia and sporangia.

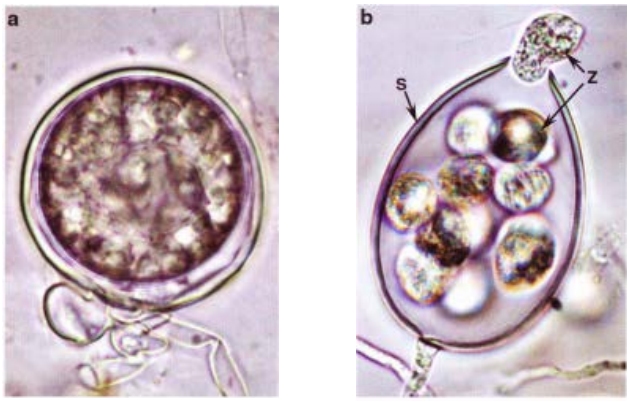



**Figure 4. *Phytophthora erythroseptica* can infect plants by means of oospores (a) or sporangium (S) and zoospores (Z) (b).**

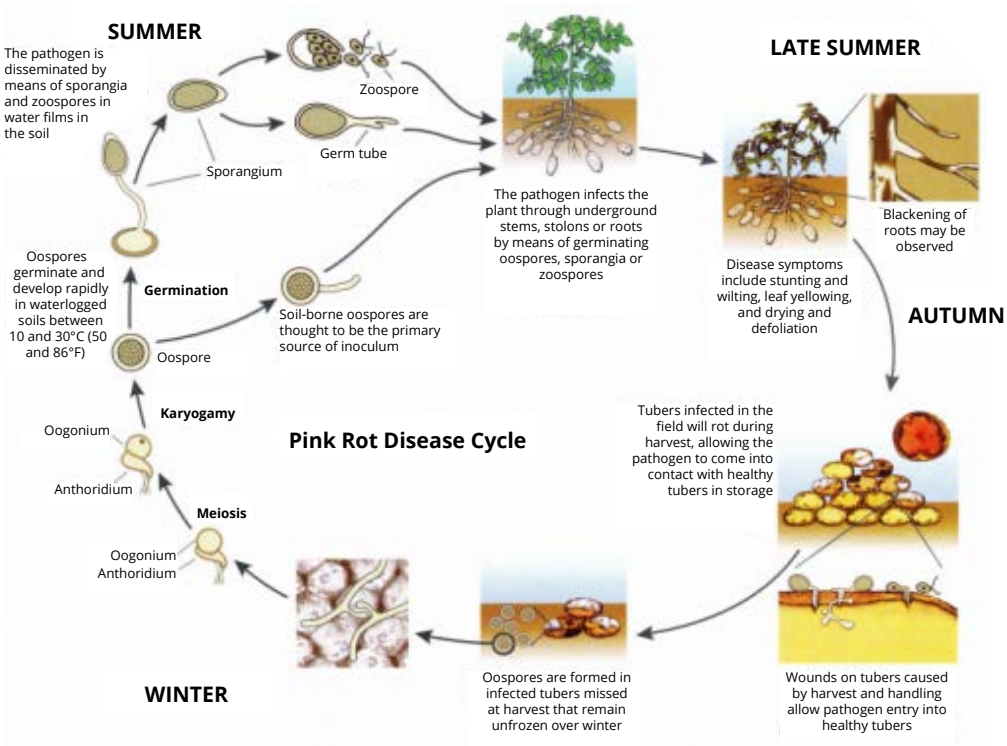
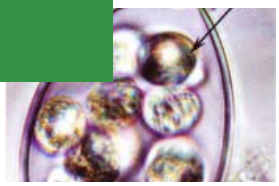



**Figure 5. The disease cycle of the pink rot pathogen, *Phytophthora erythroseptica***

This project has been funded by Hort Innovation using the vegetable research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.



Infection occurs when germinating oospores, sporangia or zoospores penetrate the epidermis of underground portions of the plant. Sporangia are the secondary source of inoculum for dispersal of the pathogen in the field or storage. Sporangia germinate, producing either a germ tube that can penetrate and infect new tubers or zoospores. **Zoospores swim freely in water films**, attach to the host surface, encyst and infect the plant. Roots, stem bases, stolons and tubers may become infected. In waterlogged soils, infection can also occur via tuber eyes and lenticels. **Disease incidence is usually higher in waterlogged areas of a field.**

**Although initial infection occurs during the early stages of tuber development, the disease becomes most apparent during harvest.**

Tubers infected with pink rot in the field will rot during harvest and handling, allowing the pathogen to come into contact with healthy tubers. **Wounds and bruises on tubers caused by harvesting and handling provide entry points for the pathogen into healthy tubers, and thus post-harvest rotting is usually more severe** than field infection.

**In moist storage conditions with poor ventilation, the disease spreads rapidly.**

## FURTHER READING AND REFERENCES

**Chemical control** - https://www.syngenta.com.au/news/potatoes/controlling-pink-rot-potatoes

**Management strategies including chemical control** - https://www.syngenta.com.au/news/potatoes/reducing-risk-pink-rot-infection-season

**Hort Innovation reports on InfoVeg website** - https://ausveg.com.au/infoveg/infoveg-database/

2000 PT97026 Developing soil and water management systems for potato production on sandy soils in Australia (a useful guide to ripping)

2001 PT97004 Potato pink rot control in field and storage, also available here: https://ausveg.com.au/app/data/technical-insights/docs/PT97004.pdf

2002 PT01042 Control of pink rot in potatoes

**Management strategies including chemical control in the US*** - https://millerresearch.com/wp-content/uploads/2019/01/WA_OR_Pink_rot_management.pdf

CropLife Australia - **Management strategies**: https://www.croplife.org.au/resources/programs/resistance-management/fungicide-resistance-management-strategies1/fungicide-resistance-management-strategies1-draft/

**Fungicide activity groups**: https://croplife.org.au/resources/programs/resistance-management/fungicide-activity-group-table-2/fungicide-activity-group-table-2-draft/

**Symptoms and disease cycle information** adapted from: https://www.canr.msu.edu/resources/potato_diseases_pink_rot_e2993

Design and content resourced from a publication of Michigan State University Extension and used with the permission of Michigan State University.

© 2015 Michigan State University All rights reserved.

* Products mentioned in this factsheet may not be registered for use in Australia.

Hort Innovation, Applied Horticultural Research Pty Ltd (AHR) and RM Consulting Group (RMCG) make no representations and expressly disclaims all warranties (to the extent permitted by law) about the accuracy, completeness, or currency of information in this fact sheet. Users of this material should take independent action before relying on it's accuracy in any way.
Reliance on any information provided by Hort Innovation, AHR or RMCG is entirely at your own risk. Hort Innovation, AHR or RMCG are not responsible for, and will not be liable for, any loss, damage, claim, expense, cost (including legal costs) or other liability arising in any way (including from Hort Innovation, AHR, RMCG or any other person's negligence or otherwise) from your use or non-use of information from project VG16078 - Soil Wealth and Integrated Crop Protection - Phase 2 or from reliance on information contained in this material or that Hort Innovation, AHR or RMCG provides to you by any other means.