

MANAGING THE RISKS OF POWDERY SCAB IN POTATOES

This guide is based on current knowledge on management of powdery scab, highlighting key factors that affect the risks of this disease and opportunities for effective disease management.

WHAT IS POWDERY SCAB?

Powdery scab is caused by *Spongospora subterranea*. This pathogen can survive for long periods in the soil (greater than 10 years). The pathogen is both seed tuber and soil borne. Disease development and the severity of symptoms vary depending on a range of factors, including inoculum levels in soil or on seed tubers, soil and atmospheric conditions, cropping history, and potato cultivar.

The disease can cause major losses of marketable yield from fresh market potato crops, and substantial rejections in processing for French fries or crisp production. Tubers with powdery scab lesions are also susceptible to other diseases. The scab lesions can be infection points for other pathogens, and powdery scab has been implicated in increasing susceptibility to tuber late blight (*Phytophthora infestans*), pink rot (*Phytophthora erythroseptica*), dry rot (*Fusarium caeruleum*) and tuber rot caused by *Colletotrichum atramentarium*.

Photo: Richard Falloon



Figure 1. *Spongospora subterranea* galls on stolon

WHAT DOES IT LOOK LIKE?

- *Spongospora subterranea* can form small white to dark brown growths (galls) on potato roots and stolons. (see Figure 1 left)
- Cankers may deform tubers.
- Scabs on tubers erupt to disperse a fine powder of spores leaving ragged edged scabs. (see Figure 2 right)
- Non-erupting scabs may develop surrounding areas of discoloured tuber tissue which is variable in size.
- Depending on temperature and progeny, tuber scabs may take 6 to 8 weeks to develop, and may not be evident in growing crops.
- Common scab and powdery scab lesions look similar. Common scab lesions tend to be more corky in appearance and angular in shape, and can be raised or pitted.

Photo: Robert Lamberts



Figure 2. Ragged edged scabs on tuber

FACTORS THAT ENCOURAGE SPONGOSPORA INFECTIONS

Potato crops are especially susceptible to powdery scab;

- During the tuber initiation phase of crop growth
- When temperatures are between 9°C and 17°C (optimum is approx. 12°C)
- When soils are wet
- In poorly drained soils (due to compaction, soil pans or over-working).



Photo: Robert Lamberts

Ragged edged scabs on skin of tuber



Photo: Richard Falloon

Spongospora subterranea galls on stolons

SPONGOSPORA LIFE AND DISEASE CYCLE

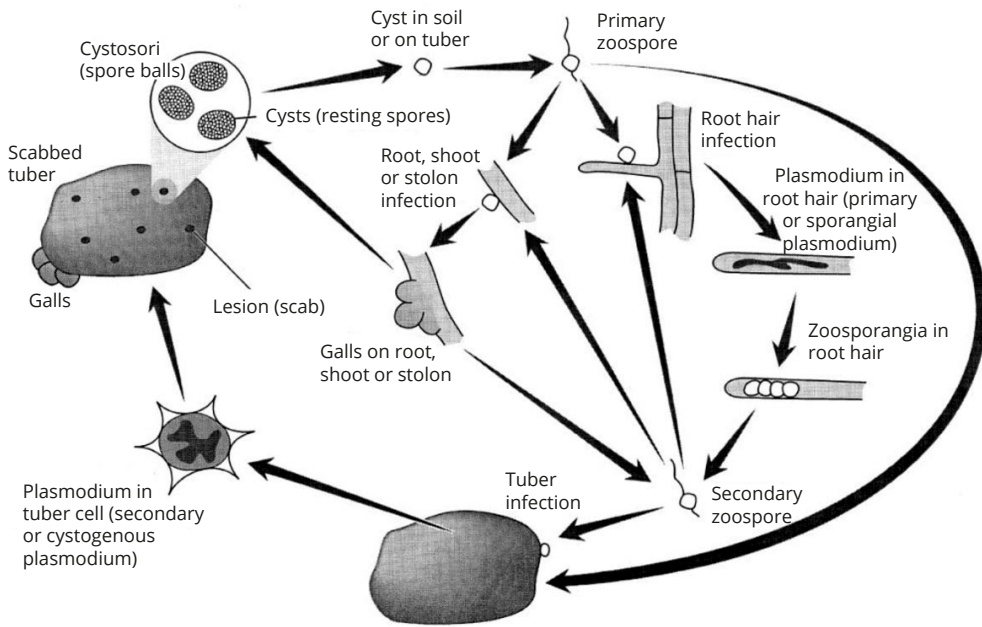


Figure 3. Diagram of the *Spongospora subterranea* life and disease cycle. [Harrison JG, Searle RJ, Williams NA, 1997. Powdery scab disease of potato – a review. *Plant Pathology* 46, 1–25.]

HOW CAN THE RISK OF POWDERY SCAB BE REDUCED?

SITE SELECTION AND FARM HYGIENE

Risks

- Previous field history of powdery scab.
- Volunteers.
- Solanaceous weeds.
- Poor drainage.
- Rotation.

Actions to manage the risk

- Consider paddock disease history when developing a rotation plan. Use PreDicta® Pt DNA testing to assess risks from pathogen levels in the soil.
- Avoid short rotations (less than 5 years) between potato crops.
- Control volunteers and weeds to minimise pathogen build-up.
- Plant at soil temperatures above the optimum (12°C) for infection. This results in rapid plant growth and less chances for infection.
- Plant high risk crops (based on varieties or market) on uncontaminated and well-drained land.
- Use uninfected, certified seed tubers.
- Do not transfer soil from paddock to paddock.
- Do not allow contractors and visitors with dirty machinery, shoes and vehicles onto paddocks.

SOIL CONDITIONS

Risks

- Cold, wet soils (particularly at tuber initiation).
- Soil compaction.
- Excessive cultivation/tillage.

Actions to manage the risk

- Avoid soils that are compacted (>2,000 kPa with a penetrometer at field capacity), and try to control traffic through paddock.
- Use of elemental sulphur (S) and maintaining zinc (Zn) at the upper end of its soil range have reduced powdery scab in the Ballarat region of Central Victoria.
 - » Results with Zn applications have been highly variable. Routine soil testing will indicate whether Zn fertiliser applications may help. High levels of phosphorus can reduce Zn uptake.
 - » Caution with S use is required as applications may cause nutrient imbalances and significant decreases in soil pH.
- Biofumigation using mustards has shown positive results when combined with less susceptible cultivars and clean seed tubers.
- Drain paddocks that have large areas prone to water logging.
- Ensure good seed beds to promote rapid and even plant emergence.
- More information on good soil management can be found at www.soilwealth.com.au

HOW CAN THE RISK OF POWDERY SCAB BE REDUCED?

CROP GROWTH

Risks

- Protracted tuber initiation periods in cold soils containing either seed or soil inoculum.
- Over irrigation and/or poor drainage during tuber initiation.

Actions to manage the risk

- Manage nutrition appropriately.
- Schedule irrigation correctly to avoid water logging and water stress (especially during tuber initiation).
- Be aware that the risk of powdery scab will increase after excessive rainfall.
- Planting tubers at shallow depth in the ridges may help reduce risk, as do other practices that encourage rapid plant emergence.
- Monitor soil moisture and keep it below field capacity (FC) during tuber initiation. If water runs from soil after irrigation or can be squeezed out of a soil sample, the soil is above FC.

POTATO GRADING

Risk

- Inoculum can contaminate grading lines and be transmitted to subsequent healthy seed tuber lines, which could infect the subsequent crop.

Actions to manage the risk

- Wash and evaluate samples of all seed tuber lines intended for grading to assess whether they are infected.
- Grade seed tubers before fresh market lines. Give priority to higher seed grades.
- Wash/disinfect grading lines at appropriate times during grading and between lines/crops.
- Fully wash down and disinfect grading lines at the end of each season (at least).
- Removing infected tubers from seed lines does little to diminish the risk for remaining tubers, as resting spores will contaminate remaining tubers.

CULTIVAR/VARIETY

Risk

- Highly susceptible cultivars.

Actions to manage the risk

Check cultivar resistance to powdery scab with your seed tuber supplier.

- Knowing cultivar resistance ratings for powdery scab along with intended market tolerances can help with paddock selection and crop management (esp. irrigation).
- Resistant cultivars can be used to reduce occurrence and severity of powdery scab. However, in seasons conducive to disease development, cultivar resistance will have reduced impacts.
- Refer to the research paper written by Genet *et al.* which provides a list of over 130 cultivars and their resistance/susceptibility to powdery scab.

STORE HYGIENE

Risk

- Dust in potato stores can be contaminated with *Spongospora* inoculum. This can be transmitted on to clean tubers in poorly cleaned stores (e.g. by forklift traffic).

Actions to manage the risk

- Ensure strict store hygiene is in place with your seed supplier.

MARKET

Risk

- Markets with zero tolerance for powdery scab, e.g. for particular seed export or fresh/ware potato markets.

Actions to manage the risk

- Check your customer/intended market tolerance to powdery scab levels. Use low risk land for markets with tight tolerances.
- Wash seed tuber samples and inspect as required.

CHEMICAL CONTROL

- In the USA and New Zealand, fluazinam can be used for powdery scab control. In Australia, this chemical is only registered for control of late blight and *Sclerotinia* in potatoes.
- Do not use unregistered pesticides or use pesticides for uses not specified on the labels. Always follow label instructions.

SEED TUBER HEALTH

Risk

- Infected seed lines, particularly when planted in uncontaminated land.

Actions to manage the risk

- Use certified disease-free seed tubers when planting into uncontaminated land.



REFERENCES AND FURTHER RESOURCES

- Potato Growers' Biosecurity Manual (2018) <https://www.farmbiosecurity.com.au/wp-content/uploads/2019/06/Potato-Growers-Biosecurity-Manual.pdf>
- Prof Calum Wilson (TIA, UTAS) discussing powdery and common scab - video <https://youtu.be/ryHPrvWcF8o>
- Falloon, R.E., Merz, U., Butler, R.C., Curtin, D., Lister, R.A., Thomas, S.M., 2016. Root infection of potato (*Solanum tuberosum*) caused by *Spongospora subterranea*: knowledge review and evidence for decreased plant productivity. *Plant Pathology* 56, 422–434. <https://bsppjournals.onlinelibrary.wiley.com/doi/full/10.1111/ppa.12419>
- Genet, R., Paget, M., Braam, F., Falloon, R., 2017. Susceptibility of potato cultivars and breeding lines to powdery scab in New Zealand: updated results from 25 years of field evaluations. *Potato Research* 60, 208–210. http://www.spongospora.ethz.ch/SA_2014/docus/day2/2nd%20Int%20PScab%20Workshop%203_%20Genet%20et%20al.pdf
- 2013 Potato PreDicta® Pt manual (ed. M Rettke, SARDI) [provided as part of Predicta® Pt Training/Accreditation Course]

A number of relevant final reports can be found on the AUSVEG website (<https://ausveg.com.au/infoveg/infoveg-database/>) and the Hort Innovation website (<https://www.horticulture.com.au/delivery-partners/resources-for-delivery-partners/research-reports-and-more/>).

- 1996 PT303 Epidemiology and control of powdery scab in potatoes
<https://ausveg.com.au/app/data/technical-insights/docs/PT303.pdf>
- 2003 PT96032 Influence of rotation and biofumigation on soil-borne diseases of potatoes
<https://ausveg.com.au/app/data/technical-insights/docs/PT96032.pdf>
- 2004 PT98018 Cleaning and disinfestation strategies on farms
<https://ausveg.com.au/app/data/technical-insights/docs/PT98018.pdf>
- 2008 PT04001 Understanding the implications of pastures on the management of soil-borne diseases of seed potatoes
https://ausveg.com.au/app/data/technical-insights/docs/PT04001_complete.pdf
- 2014 PT09039 (<https://ausveg.com.au/app/data/technical-insights/docs/PT09039.PDF>) which includes the following APRP2 programs: PT09026- Soil health disease mitigation program, PT09026A(i) - Soil amendments and nutrients, PT09026(ii) - Impact of rotations, PT09019 - Comparison between DNA testing and visual methods for assessing seed tuber health
- 2018 PT14002 *Spongospora* infection of potato roots – ecology, epidemiology and control
<https://ausveg.com.au/app/uploads/technical-insights/PT14002v2.pdf>

ACKNOWLEDGEMENTS

This factsheet has been adapted from:

- Managing the risk of powdery scab (2007) Mark Prentice, Rob Clayton, Jeff Peters and Stuart Wale. British Potato Council
- A review of knowledge gaps and compilation of R and D outputs from the Australian Potato Research Programs (2015) Kevin Clayton-Greene. Horticulture Innovation Australia (<https://ausveg.com.au/app/data/technical-insights/docs/pt13.PDF>).

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