

# Potato tuber treatments



Figure 1. Seed sample wash up to check quality

## Action points

- Determine the likely disease loading of your seed
- Assess the risk of soilborne disease from your proposed site
- Consider which varieties, that your customer requires, are best suited to the identified disease risks
- Plan a growing strategy to minimise the risk of disease development
- Consider treatment options where risk is greatest
- Plan how and when treatments are likely to be most effective

## Integrated Pest Management (IPM) approach

Dry rot and gangrene can cause loss of tubers both in store and in the field. Black dot, black scurf, silver scurf and skin spot are skin finish diseases but can affect the number of viable eyes. Soilborne rhizoctonia causes stem and root pruning. All these diseases can be difficult to control and require changes to variety selection, soils, nutrition and agronomy.

## Factors affecting potato diseases transmitted by seed or soil

### Black dot (*Colletotrichum coccodes*)



### Variety and seed

Varietal resistance can be useful in managing black dot, e.g. Maris Piper resistance rating (4) compared with Saxon (6). Infection can arise from both seed and soilborne inoculum.

### Weed and crop hosts

Sclerotia of black dot can survive on plant debris between host crops. Extending rotations can help minimise disease survival, provided host weeds are controlled. These include solanums, such as black nightshade, but also some legumes and cucurbits.

### Crop stress

Maintaining an adequate supply of nutrients and water to reduce crop stress can help combat a range of diseases including black dot. Development on tubers is favoured by wet growing conditions and may be encouraged by late irrigation or excess rainfall near crop maturity.

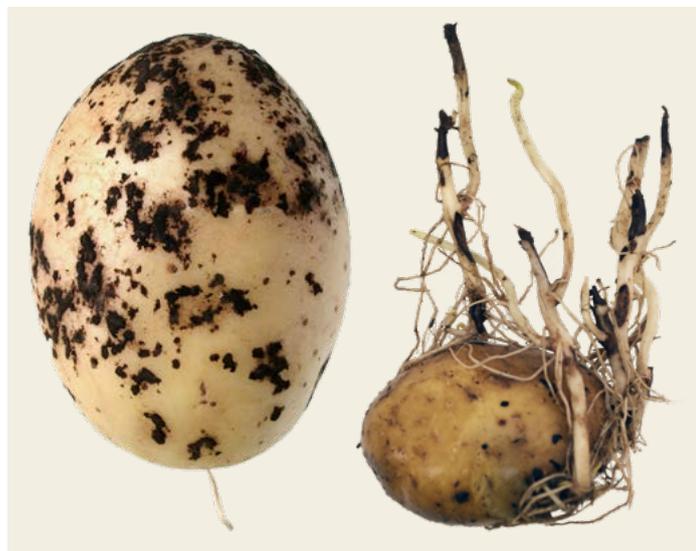
### Crop duration

The longer the crop is in the ground and exposed to inoculum, the greater the severity of black dot (Peters et al, 2016). This aspect overrides absolute harvest date.

### Crop storage

Symptoms are increased by warm, moist storage conditions. Once skins are set, then store temperature should be pulled down to holding temperature at a rate of 0.5°C per day. This is especially beneficial to higher-risk varieties.

### Black scurf and stem canker (*Rhizoctonia solani*)



Left: black scurf. Right: stem canker

### Variety and seed

Varietal resistance can be useful in managing black scurf/ stem canker, e.g. Nectar resistance rating (4) compared with Daisy (8). Seedborne inoculum is especially important, even where soil is contaminated. Seed treatments can provide good control of seedborne infection but should be supported with soil treatment in high-risk situations.

### Weed and crop hosts

Short rotations increase the risk of rhizoctonia disease sustaining itself to infect following crops. Several crops and weeds host one or more strains of *Rhizoctonia solani*.

### Crop stress

Avoid any stress that delays emergence, e.g. planting non-sprouted seed too deep, especially if on lighter soils in dry conditions, as this can exacerbate disease. Control potato cyst nematode (PCN) which interacts with *Rhizoctonia solani* and exacerbates the disease (Back et al, 2010).

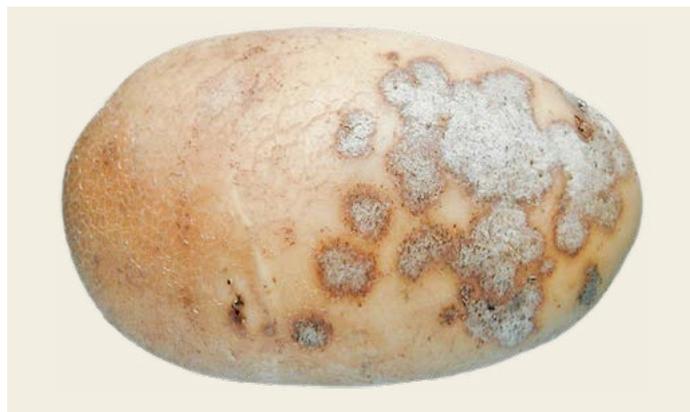
### Crop duration

The longer the crop is left in the ground after haulm destruction, the higher the risk of black scurf developing. Black scurf development is slower after haulm pulling than after chemical desiccation.

### Crop storage

Black scurf infection can increase in store in situations where large amounts of moist soil are present and in high temperatures. Dry cure and pull down the temperature of at-risk stocks by 0.5°C per day to holding temperature to minimise disease growth.

### Silver scurf (*Helminthosporium solani*)



### Variety and seed

The fungus causing silver scurf is ubiquitous; often present on seed, in soils and in dusty stores. Seedborne infection can often go undetected. In extreme situations, affected skin may slough off, leading to tubers becoming dehydrated, even shrivelled. Seed treatment can help to limit disease; however, varietal resistance is largely irrelevant.

### Crop storage

Warm, moist conditions in store can encourage spread. Dry curing stocks and storing at low temperatures, below 3°C (market permitting), can limit the spread of disease.

### Dry rot (*Fusarium spp.*)



### Variety and seed

Varietal resistance varies according to *Fusarium spp.* Some are very susceptible, e.g. Maris Piper: *F. sulphureum* (2), *F. coeruleum* (3). Avoid planting infected seed. DNA diagnostic tests are available to check on the presence and levels of *Fusarium spp.* in seed. The more pathogens present, the more severe the disease (Cullen et al, 2005).

### Weed and crop hosts

Fungus is largely soilborne with infection occurring during harvesting and grading. Alternative crop hosts should be borne in mind when planning to grow susceptible varieties.

### Crop storage

Avoid excessive mechanical damage especially at grading and before planting. Warm, humid storage conditions favour *Fusarium spp.*, therefore store crops in cool, dry conditions. While chemical treatment can provide some control when applied soon after lifting, note that strains of *Fusarium spp.* insensitive to thiabendazole are prevalent.

### Skin spot (*Polyscytalum pustulans*)



#### Variety and seed

No varieties are resistant, but some are more susceptible than others, e.g. King Edward (3), Electra (8). Chitting seed early and disposing of blind tubers will help to support a good plant stand.

#### Crop storage

Low temperatures and a high relative humidity favour infection, both during storage and the growing season. Avoid harvesting susceptible varieties in wet, cold conditions. Store crops dry and ensure susceptible varieties (crops) are well cured at 16–18°C for several days post-harvest.

### Gangrene (*Phoma foveata*)



#### Variety and seed

Some varieties are very susceptible, e.g. Shepody (1). The fungus may be tuber or soilborne. Avoid diseased seed.

#### Crop storage

Allow skins to set well before harvest. Minimising damage especially during low temperatures can help. Curing under warm conditions (13–16°C) for up to 10 to 14 days after harvest can help reduce gangrene. Chemical treatments applied as soon after lifting as possible can reduce problems in store but not in the subsequent crop. Low-temperature storage can exacerbate problems, especially in thinner-skinned varieties.

### Powdery scab (*Spongospora subterranea*)



Source: Van De Graaf et al, 2005

#### Variety and seed

Powdery scab is the only means of transmission of potato mop-top virus (PMTV) other than seed. PMTV is an important cause of spraing. Resistance to powdery scab can also protect against PMTV. Examples of relatively resistant varieties are Royal (6) and Taurus (7).

#### Temperature

AHDB Potato/SEERAD work has shown that infection can take place across the temperature range of 9–17°C with the optimum for causing disease around 12°C.

#### Moisture

Free moisture is needed for infection to enable zoospores to swim to the host plant.

#### Soil pH

Disease is slightly greater in alkaline rather than acid soils.

#### Soil type

Powdery scab has been found in all soil types. Heavier soils may favour the disease, though research has not been conclusive on the influence of soil type. Soil moisture was the key factor associated with disease expression.

#### Soil drainage

Poorly drained soils which hold soil moisture throughout the profile are associated with a greater risk of powdery scab. Powdery scab is encouraged by overcultivation (e.g. use of a bed tiller) to produce a fine tilth that slumps or compacts and holds more water.

Following implementation of an IPM approach, if risk factors are still present, a programme of seed tuber or soil treatments may be necessary. Information on chemicals is provided in Table 1, on a card in the pocket of this factsheet.

### Factors affecting suitability of tubers for treatment

#### Skin set

Treatments are more effective when skin set is complete and there are no harvest wounds. Avoid damage to tubers from pulling out an immature stolon, which allows possible bacterial and/or fungal infection. A major difference may be seen between varieties in the strength of stolon attachment.

It is harder to achieve a good skin set with some varieties than others. If skins are not fully set or damage is likely to occur at harvest, consider application of a fungicide to prevent further disease spreading. Dry rot and gangrene are particular threats if skin is damaged.

### Dormancy

Treat seed while as dormant as possible. Dormancy breaks gradually, with early stages ranging from eyes open to a chit being present but not proud of the eye. Treat while it is possible to do so without damaging the shoot. Some products are more phytotoxic than others when applied to partially sprouted seed. Consult a specialist adviser.

### Dirt and moisture

The chemical products are only effective if good coverage is achieved. When there is significant soil on tubers, it can be better not to treat pre-storage but to wait until the first grading. If tubers are wet, then application can be made, followed by curing pre-storage.

Specialists in tuber treatment find the most common questions asked are, “Is this skin set adequate?” and “Can I still treat at this level of dormancy?” The above factors all vary across a range, often within the same batch of tubers, and assessment is largely subjective. They should be considered together when making decisions.

### Timing of chemical treatments to seed potatoes

Treatments can be divided into two categories. One protects against storage diseases: gangrene, dry rot, silver scurf and skin spot, while the other protects against field diseases, primarily rhizoctonia and black dot. Storage disease treatments should be applied within 7–10 days of harvest while the inoculum levels are low. Field disease treatments are applied close to planting but while the tubers are as dormant as possible.

Minimise handling. If possible, apply tuber treatments at scheduled handling events, rather than adding an extra process. Physical impact or a sand-paper-type rubbing action of soil particles can cause skin splitting or damage.

### At harvest

Fungicides applied at this stage reduce dry rot, gangrene, silver scurf and skin spot. Treatment is usually via the “drop method”, with the tubers falling through a mist of spray droplets. The timing, at harvest, is ideal to apply active ingredients early in the process of disease infection. There is limited potential, because this approach is only possible when the whole crop is to be used for seed.

#### Pros

- Applies active ingredient early in the process of infection

#### Cons

- Very variable quantities of active ingredient contact tuber surfaces
- Positioning of nozzles is important to achieve good coverage and may require adjustments as conditions change

### Grading into store

May be required or appropriate if harvest conditions are wet and if a ware fraction needs separation. Separate soil and ware fractions first, then apply treatment over a roller table. Use of a hood and rotating nozzles for this application has been shown to give a uniform spray pattern (see Figure 3).

#### Pros

- Most effective timing to apply treatments for dry rot, gangrene and skin spot
- Uniform coverage at the correct rate can be achieved with correct nozzles
- Provides opportunity to apply a mix of products

#### Cons

- High throughput at harvest requires applicators to be capable of treating large volumes per hour and be well calibrated and supervised during application
- Treated tubers need to be dried after treatment and cured if appropriate



Figure 2. Grading into store

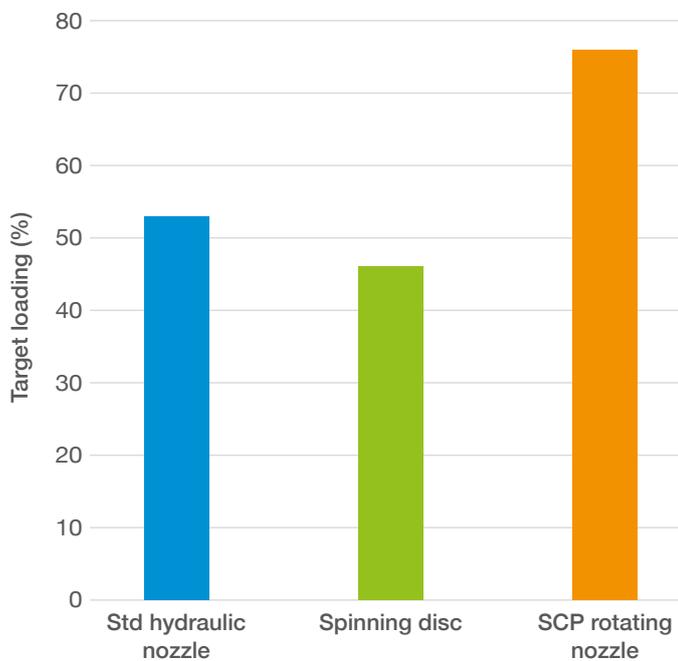


Figure 3. Efficacy of application by different nozzle types, Syngenta & Team Sprayers

### First grading

Such grading occurs during the early storage period, November to February.

Products applied at this stage may either be those to control diseases in store or those to control field diseases when the seed is planted.

For control of store diseases, this timing allows use of alternative active ingredients to provide a sequence, with an earlier application for greater efficacy and to combat development of resistance.

#### Pros

- Depending on machinery available, this may allow roller-table application which was not possible at store filling

#### Cons

- Too late for best control of gangrene and dry rot
- Dormancy break may be an issue. If the seed is starting to chit, then early application of pre-planting treatments may be advisable. If the crop is totally dormant, there is an option to delay treatment until just prior to dispatch. The process of grading itself can increase the likelihood of sprouting

### Grading out of store

Application may take place either at the store or on the receiving farm when transferring from the seed bag to a box for short-term storage. Seed should be dormant or with eyes just open. Apply over a roller table with a hood and rotating nozzles.

#### Pros

- Uniform coverage at the correct rate can be achieved
- Ideal time to apply actives for field diseases: rhizoctonia and black dot
- Opportunity to treat seed when the skins are cured and soil is more readily removed to expose a cleaner skin

#### Cons

- This stage is too late for good control of dry rot, gangrene and skin spot because wounds infected at harvest have healed out of store



Figure 4. Top: roller table in operation. Bottom: rotating twin nozzles under the hood

### Pre-planting

Pre-planting options are traditionally powders and mainly for rhizoctonia control. They are aimed at enhancing daughter-tuber skin finish and reducing the “mother tuber to daughter tuber” disease transfer.

#### Pros

- Easy to use powders
- Economical treatment of seedborne rhizoctonia

## Cons

- Reduced active ingredient can reach the tuber surface when applying powders on a belt planter
- Potato planting is a dusty operation, particularly in windy weather. Appropriate PPE as per label must be worn



Figure 5. Top: tubers which have broken dormancy but are still suitable for treatment. Bottom: tubers too late for liquid roller-table treatment



Figure 6. Powder applicator on a belt planter

## In-furrow treatment at planting

Liquid fungicides sprayed into the furrow control soilborne diseases. To avoid blocking nozzles, use a high water rate, approximately 100 l/ha. The aim is to achieve evenly treated soil around the tuber. The machine calibration and nozzle angle required depends on bed design, soil type and soil conditions.



Figure 7. In-furrow application. Top: three-row planter with two nozzles in each shoe. Bottom: quad planter with rear nozzles only

## Regulations and advice

Take advice on nozzle sizes, flow rates, concentrations and timing from chemical suppliers and machinery manufacturers. Take advice from a BASIS-qualified agronomist on methods of assessing disease risk, product selection, appropriate timing and application method.

All applicator machinery requires an NSTS test if more than five years old.

All operators applying fungicide to seed potatoes require NPTC certification:

- PA2 for in-furrow applications on the planter
- PA12 for liquid and powder applications to seed tubers



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### Further information

Diseases and defects poster

[ahdb.org.uk/knowledge-library/diseases-and-defects-of-potatoes-poster](http://ahdb.org.uk/knowledge-library/diseases-and-defects-of-potatoes-poster)

Managing the risk of black dot factsheet

[ahdb.org.uk/black-dot](http://ahdb.org.uk/black-dot)

Managing the risk of dry rot guide

[ahdb.org.uk/knowledge-library/managing-the-risk-of-dry-rot](http://ahdb.org.uk/knowledge-library/managing-the-risk-of-dry-rot)

AHDB online pests and diseases gallery provides general information on symptoms and guidelines on control

[ahdb.org.uk/knowledge-library/potato-disease-tool](http://ahdb.org.uk/knowledge-library/potato-disease-tool)

### References

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Van De Graaf P, Lees A, Wale S, Duncan J. (2005). *Effect of soil inoculum level and environmental factors on potato powdery scab caused by Spongospora subterranean*. *Plant Path.* 54 (1) 22-28

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