

Potato tuber diseases: Determining the requirement for a fungicide seed treatment

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Before deciding on using a fungicide:-

- Consider cultural disease control
- Be sure of customer requirements
- Sample and wash tubers from a stock to identify target diseases
- Assess level of damage to a stock
- Determine whether or not a stock is treatable (is it wet or soil covered)

Fungicide treatment of potato seed constitutes a key method for control of diseases including silver scurf, skin spot, dry rot, gangrene and black scurf/stem canker. However, it is not the only method of control and should be used in conjunction with good cultural control techniques (*Table 1*). Seed should only be treated once a need for treatment and an appraisal of the potential benefits has been undertaken. Samples of seed should be drawn from stocks, washed and assessed for the presence of each disease prior to deciding upon a seed treatment. Consideration should also be given to the amount of damage present within the stock and a judgement as to whether or not the stock is suitable for treatment should be made.

Seed stock assessments

Assessment of the amount of disease present on a stock should help determine whether or not fungicide treatment is necessary. Draw 100 tubers at random from each 20 tonnes of a stock and avoid selecting tubers from the tops of boxes as these will not truly reflect the whole stock. Wash tubers and assess for presence of silver scurf, black scurf, black dot and powdery scab. Where silver scurf is present on over 5% of tubers or black scurf is present on any tuber then fungicide application is likely to be beneficial (providing uniformity of size and freedom from

Table 1. Cultural control techniques to use in conjunction with seed treatment fungicides.

	Silver scurf	Skin spot	Dry rot	Gangrene	black scurf/ stem canker	black dot
Choosing a variety with good resistance		+	+	+		+
Minimising damage ¹		+	+	+		
Early harvest	+	+		+		
Dry curing	+	+	+	+		+
Low holding temperature	+		+		+	+
Chitting seed					+	
Long rotation					+	+

¹Techniques that minimise damage include good seed bed preparation, de-stoning, good skin set, correct harvester setting and careful handling at grading etc.

+ = some control achievable

disease is a market requirement). Skin spot, gangrene and dry rot are unlikely to be present early in storage. An assessment of the level of damage, varietal susceptibility and harvest date will help determine whether fungicide is necessary to control these three diseases. Late harvested susceptible varieties are likely to require treatment for skin spot and gangrene, particularly if damage levels are high. Early harvested susceptible varieties are likely to require treatment for dry rot, particularly if damage levels are high. Where soft rotting is present within a stock, fungicide treatment may exacerbate the problem. These stocks should be ventilated to dry out any rotting and then reassessed for suitability for treatment.

Where an earlier indication of presence of skin spot and silver scurf is required, then eyepug incubation tests are available. During these tests, presence of *Rhizoctonia* (the fungus that causes stem canker) within eyes is also assessed.

Damage assessment

Assessment of the level of damage either at harvest or during grading will help determine the requirement for protection against dry rot, gangrene and skin spot.

Carefully wash 100 tubers and count the numbers of tubers on which scuffing is present, damage that is easily removed by one stroke of a peeler is present and more severe damage is present. Multiply the numbers of tubers in each category by 1, 3 and 7 respectively and add these together to calculate a damage index (DI). Fungicide treatment may be beneficial if DI is greater than 100 for dry rot or gangrene susceptible varieties particularly if either disease has been recorded in the stock's or farm's history. Fungicide treatment may also be beneficial if levels of scuffing are high for a late lifted, skin spot susceptible variety.

Suitability of stocks for treatment

Fungicides should only be applied to stocks that are in a suitable condition for treating. When a stock is not suitable

for treating, then benefits from a treatment are less likely. Unsuitable stocks include those that contain a high level of soft rotting, those that are wet or those that have a covering of soil that would prevent fungicides from contacting the tuber surface.

Various agronomic factors can interact to seriously affect the emergence and establishment of potato crops. There is a possibility of further interaction of these factors with chemical seed treatment, making it very difficult to foresee the outcome in all situations. See product labels for full details.

Timing of application

In order to maximise the benefits from fungicide use, application at the appropriate timing is essential. For damage related diseases (dry rot and gangrene) early treatment is essential to avoid disease development within the tuber. Once these pathogens start to develop within the tuber it more difficult to control them. For liquid fungicides (eg. imazalil) application at harvest or into store may be appropriate. Fumigant fungicides (eg. 2 aminobutane) can penetrate several millimetres into the tuber and provide control against gangrene. If used inappropriately they can scorch the tuber surface so stocks should be cured prior to use and treatment applied 2-3 weeks into storage. Treatment of very cold potatoes or varieties that are highly susceptible to dry rot should also be avoided (*note. Use of 2 amino-butane is not approved on ware potatoes*). Fungicides that reduce development of silver scurf and skin spot in store should also be applied soon after harvest. This may either be on the harvester or early in storage when crops are split graded. Fungicides can also be applied to reduce the development of silver scurf and skin spot in the daughter crop (Table 2). If not applied earlier these may be applied prior to planting providing crops are suitable for treatment. There is also some evidence to suggest that two applications (one at harvest and one prior to planting) can further reduce disease in the progeny crop.

Table 2. Main Fungicides for potato tuber treatment (diseases controlled by fungicide treatment in the absence of fungicide resistance)

Fungicide	Skin spot	Silver scurf	Gangrene	Dry rot	Black dot	Black scurf
<i>At harvest or grading (for control of development in store)</i>						
2-aminobutane	+++	+	+++	-	n	-
Imazalil	+++	+++	+++	+++	++	-
Thiabendazole	+++*	++*	+++	+++*	++	-
Imazalil + Thiabendazole	+++	++	+++	+++	++	-
<i>At grading or pre-planting (for control of spread to progeny tubers)</i>						
Imazalil	++	++	-	-	++	-
Iprodione	-	-	-	-	-	++
Thiabendazole	+*	+*	-	-	++	+
Imazalil + Thiabendazole	++	++	-	-	-	+
Pencycuron	-	-	-	-	-	+++
Pencycuron + Imazalil	+	++	-	-	+	+++
Tolclofos - methyl	-	-	-	-	-	+++

+++ = excellent control; ++ = good control; + = some control; - = not recommended for control; n = no data available

* = resistance to thiabendazole is common for these fungi

Fungicides are also available for control of black scurf and stem canker. They are best used close to the time of planting but before sprout development. They may be beneficial on stocks where black scurf has been observed or where the *Rhizoctonia solani* fungus has been detected in eye plug incubation tests.

Always check the product label before treating.

Fungicide resistance

Resistance to thiabendazole (TBZ) has been detected in three pathogens: *Helminthosporium solani* (silver scurf), *Polyscytalum pustulans* (skin spot) and *Fusarium sulphureum* (a dry rot species).

Research has shown that thiabendazole resistance can develop within one season after treatment with TBZ and can persist thereafter even if thiabendazole is no longer used.

Where possible, a strategy that minimises the risk of development of fungicide resistance should be adopted.

- Only use a fungicide if one or more of the following apply:-
 - ❖ the variety grown is highly susceptible to a specific disease

- ❖ there is a history of persistent disease on the farm
- ❖ significant levels of the disease were present on mother tubers
- ❖ presence of a disease would have a major effect on marketability
- ❖ treatment constitutes part of a contract

- An integrated control strategy should be adopted, where possible, to include lifting at the earliest date possible, dry curing, adequate store hygiene and cold storage.
- Minimise repeated use of the same fungicide from year to year throughout a multiplication programme.
- Consider the use of products constituting a mixture of active ingredients.
- Limit the use of thiabendazole alone to use on ware tubers.
- If treatment is needed on seed tubers destined for pre-pack production, use only 2-aminobutane or imazalil for silver scurf and skin spot control.
- TBZ/imazalil mixture may be used on seed of processing varieties.
- Once grown seed from ware should not be treated with TBZ.

Disease profiles

Silver scurf



Silver scurf (*Helminthosporium solani*) is a surface blemishing fungus that affects pre-pack product value. There is evidence to suggest that the most effective time to control the disease is in the year of ware production. However, this can lead to high numbers of spores being present within stores which increases the risk of contamination of clean stocks early in multiplication. Fungicide applications to seed both into and out of store have provided good disease control. Treatment of the stored ware crop with thiabendazole or imazalil is also permitted.

Where silver scurf is controlled, levels of black dot may increase if soil-borne inoculum is present.

Black dot



Black dot (*Colletotrichum coccodes*) is a surface blemishing fungus that affects pre-pack product value. There is some evidence to suggest that application of imazalil or thiabendazole to seed may reduce spread to progeny tubers. However, much of the disease is soil borne so results can be variable.

Skin spot



Skin spot (*Polyscytalum pustulans*) is a surface blemishing disease affecting both pre-pack and processing product value. It may also cause non-emergence of seed if eyes become infected. If left unchecked, the fungus can increase throughout seed multiplication. Application of fungicide throughout seed multiplication, following anti-resistance guidelines is recommended particularly on susceptible varieties. Best results have been achieved in the past by applying chemical treatments at store loading rather than prior to planting. Cultural control measures i.e. starting with high grade seed, early lifting, maintaining high levels of store hygiene and drying produce into store are essential components of an effective control strategy.

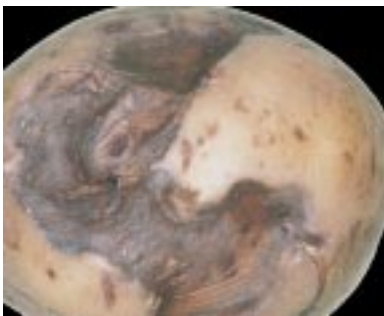
Dry rot



Dry rot (*Fusarium* spp.) is a tissue rotting fungus that affects seed and ware quality and provides entry for bacterial soft rotting. Application of fungicides throughout seed multiplication is recommended where dry rot risk is high (e.g. susceptible varieties, early harvest and high temperature storage etc.)

Treatment with imazalil and with TBZ in the absence of TBZ resistance have proved effective in reducing disease levels but should only be used in conjunction with good cultural control measures (e.g. planting in warm seed bed, allowing skin to set prior to harvest etc.) Treatment with 2-aminobutane should be avoided for dry rot susceptible varieties.

Gangrene



Gangrene (*Phoma foveata*) is a tissue rotting fungus that affects potatoes stored at low temperatures. Seed treatments have not proved effective at reducing levels in progeny crops but treatment at harvest with imazalil or 2-aminobutane may reduce development in store. Disease control by cultural methods is recommended including minimising damage at harvest and adequate curing.

Black scurf



Black scurf (*Rhizoctonia solani*) is a seed and soil borne disease that reduces prepacking quality. The fungus also causes stem canker which affects sprout development and can cause blanking and a change in size distribution within the daughter crop. Seed treatment prior to planting can help reduce levels of stem canker and black scurf. Cultural control includes using well sprouted seed, avoiding planting into cold soils, avoiding infected seed and ensuring sufficiently long (greater than 5 years) rotations.

SUMMARY OF FUNGICIDE USE FOR DISEASE CONTROL

- **Silver scurf:** Treat seed both in and out of store with imazalil-based fungicide
- **Black dot:** Mostly soil borne, but imazalil or thiabendazole may reduce some tuber infection
- **Skin spot:** Treat seed in-store following anti resistance strategy with fungicides imazalil and thiabendazole
- **Dry rot:** Treat seed in-store following anti resistance strategy with fungicides imazalil or thiabendazole. 2-aminobutane provides no control
- **Gangrene:** Curing is important to minimise disease. Imazalil, thiabendazole or 2-aminobutane may also provide some control
- **Black scurf:** Apply seed treatment containing penicuron or tolclofos-methyl prior to planting

ALWAYS CONSULT THE PRODUCT LABEL

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