Managing the risk of dry rot

BRITISH POTATO COUNCIL

Dry rot is the most important fungal rot of potatoes in Great Britain. The disease affects around 1% of tubers annually. However, its true impact on the industry is often underestimated because the disease enables Erwinia species to colonise and develop into soft rots.

There is a potentially higher risk of dry rot in British crops due to:

- Extended use of susceptible varieties to meet market needs, e.g. Hermes, Maris Piper, Estima. These account for about a third of the total area grown
- Hard-grading to meet customer requirements at a time when tubers are at their most susceptible
- Earlier harvesting for seed management and blemish control
- Less curing due to emphasis on blemish control
- Recent BPC surveys confirming cases of fungicide insensitivity

There are three key questions:

- Are your varieties susceptible to dry rot?
- Is dry rot control a priority for your seed supplier?
- Have you had rot problems in the past that you've put down to blackleg or blight?

Managing the risk of dry rot

	LOW RISK	HIGH RISK
Variety	Low/moderately susceptible varieties e.g. Lady Rosetta, Sante, Saturna *Be aware, that dry rot can occasionally be a problem due to Lady Rosetta's susceptibility to Fusarium sulphureum.*	Highly susceptible varieties e.g. Hermes, Estima, Maris Piper
Site	Long rotation (7 years or longer) No volunteer problem	Previous history of dry rot on farm Warm, sandy soils Volunteer problem
Seed health	No obvious dry rot on seed	Evidence of dry rot on seed
Crop growth	Stress-free conditions	Warm and dry season
Harvest	Low damage Good skin set	Early harvest (August to mid-September) High damage Poor skin set
Storage	Adequate curing Low holding temperature	Minimal/poor curing High holding temperature
Grading	Effective hygiene policy with clean equipment and regular disinfection Careful handling	Using contaminated/uncleaned boxes and graders High damage due to aggressive grading
Fungicides		If HIGH RISK for variety, seed health and site, consider fungicide use For best protection, treat early

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RISK FACTOR	ACTION	
Variety	**Check varietal susceptibility in NIAB/BPC Pocket Guide – go to www.potato.org.uk or contact your seed supplier** 	It is worth considering how susceptible your varieties are to the different Fusarium species when assessing the risk of developing dry rot. However, as there are a number of species that can cause dry rot, published information on variety susceptibility ratings is not available for all variety/pathogen combinations. The table opposite gives our current knowledge on varietal susceptibility.
Site	**Check field records for history of Fusarium in all crops**	The four Fusarium species listed in the table opposite are all capable of producing dry rot in potatoes. However, some are also pathogens on other crops:
Seed health	**Use certified seed, especially for susceptible varieties** **Ask your supplier about dry rot incidence prior to inspection** **Check for uniformity in seed crop**	Fast and reliable DNA diagnostic tests exist for detecting and measuring levels of Fusarium species. The more pathogens present on the tuber, the more severe the disease (Cullen et al, 2005).
Crop growth	**Avoid stress through cultivation to reduce compaction and scheduled irrigation** **Plan nitrogen inputs to promote skin set/senescence**	
Harvest	**Allow suitable interval after haulm destruction for skin set** **Optimise harvester set-up (see BPC Harvester Settings Guide) and assess damage frequently**	Be aware that inoculum of Fusarium species either builds up or declines during this period (see figure opposite). This could alter decisions on fungicide use. For example, you should consider avoiding thiabendazole (TBZ) applications for late harvested crops.
Storage	**Cure any damage adequately** **Be aware of increased risk of dry rot at high storage temperatures (e.g. in crops destined for processing)**	Table 1 shows the effect of temperature on curing rate - see also BPC Store Managers' Guide 
Grading	**Ensure store hygiene policy is in place** **Warm crops prior to grading and allow skin recovery after warming to minimise thumbnail cracking.** **Work gently from January - March when tubers are at their most sensitive**	Consult the BPC Store Hygiene CD 
Fungicides	**Follow best practice guidelines for fungicide application (see BPC Grower Advice).** **Consider tank-mixing imazalil and TBZ for high risk seed**	In a recent BPC-funded survey of dry rot (Peters & Lees, 2004), some isolates of *F. sulphureum* and *F. culmorum* were resistant to TBZ; and some isolates of *F. avenaceum* were resistant to imazalil.

(Fusarium spp.)

TECHNICAL

Level of cultivar resistance to Fusarium species

	Hermes	Estima	Marfona	Maris Piper	Russet Burbank	Lady Rosetta	Saturna
F. avenaceum	Susceptible	Susceptible	Resistant	Resistant	Resistant	Moderate	Resistant
F. coeruleum	Moderate	Moderate	Susceptible	Susceptible	Moderate	Resistant	Moderate
F. culmorum	Susceptible	Moderate	Resistant	Resistant	Resistant	Resistant	Resistant
F. sulphureum	Susceptible	Susceptible	Susceptible	Susceptible	Susceptible	Susceptible	Moderate

Ratings were estimated by measuring volume of rot in test cultivars after inoculating tubers with pathogen spores (Peters & Lees, 2004).

Alternative hosts

F. avenaceum	cereals	peas/beans	forage legumes	carrots	woody plants
F. coeruleum	-				
F. culmorum	cereals	sugar beet	onions	carrots	cucumber
F. sulphureum	woody plants				

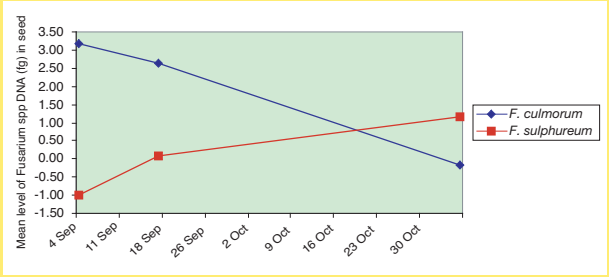
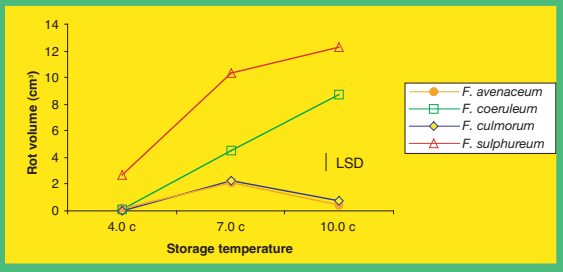


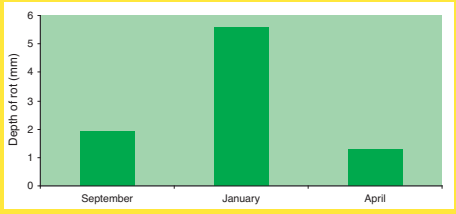
Figure shows how levels of inoculum (for two Fusarium species) on seed changes with time.



In susceptible varieties, rots are more severe at temperatures above 4°C. The figure above shows rot development in Maris Piper at 4, 7 and 10°C after inoculating with spores of four Fusarium species.

How many days does curing take?

	Initial	Complete
< 5 °C	7-14	21-42
10 °C	4	7-14
20 °C	1-2	3-6



Tubers (cv Estima) were more susceptible to infection by *F. coeruleum* during the middle of January compared with those at harvest (September) and grading (April).

Source: Hilton, Stevenson & Clayton (2002)

Percentage resistance within GB populations of each Fusarium species

	imazalil	thiabendazole (TBZ)
F. avenaceum	9	<5%
F. coeruleum	0	0
F. culmorum	0	7
F. sulphureum	0	65

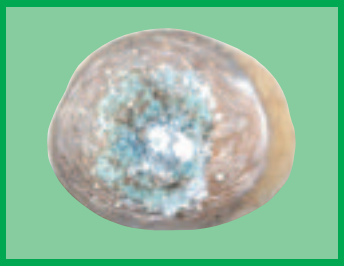
Source: Peters, Lees, Sullivan, Cullen, Stroud & Cunnington (in prep).

It is essential to follow the instructions given on the approved label before handling, storing or using any fungicides or other crop protection product. USE PESTICIDES SAFELY, ALWAYS READ THE LABEL. Always consult your buyer protocols before using any pesticide

References:
Peters, JC & Lees, A (2004). *Regional variation among Fusarium species causing dry rot of potato.* BPC project report.
Cullen, DW, Toth, IK, Pitkin, Y, Boonham, N, Walsh, K, Barker, I, and Lees, AK (2005). *Use of quantitative molecular diagnostic assays to investigate Fusarium dry rot in potato stocks and soil.* Phytopathology, 1462-1471.
Hilton, AJ, Stevenson, LR and Clayton, RC (2002). *Influence of tuber maturity and wounding on infection of potatoes by Fusarium coeruleum.* Proceedings Crop Protection in Northern Britain, Dundee, 2002.

Dry rot identification and species distribution

Fusarium coeruleum



The most common species in Eastern and Northern Britain

Fusarium sulphureum

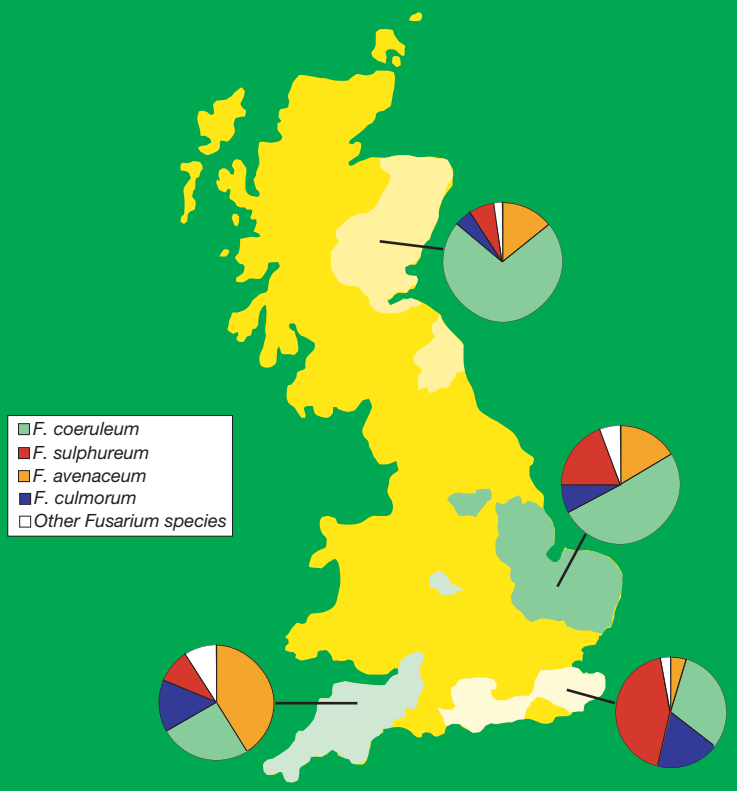
TBZ resistance is a potential problem – 65% of isolates are resistant.

Fusarium avenaceum

Imazalil resistance is a potential problem - 9% isolates are resistant

Fusarium culmorum

A potential problem for susceptible varieties (e.g. Hermes) following cereals



A survey of over 20,000 stored healthy tubers between 2001-2004 (Peters & Lees, 2004) showed that the distribution of the four main Fusarium species varies enormously from region to region (based on 272 incidences). However, *F. coeruleum* was the most common species overall.

BASIC IDENTIFICATION OF DRY ROT

For *Fusarium coeruleum* infections, the skin appears wrinkled in concentric rings around the infected area with white or blue mould present. Internal cavities are often present. Affected flesh often banded light and dark brown. Margin between healthy and diseased tissue not distinct.

Fusarium sulphureum causes a similar rot but the cavity tends to be more pronounced. Mould on surface but not blue.

Fusarium avenaceum produces a dark brown rot.

Fusarium culmorum produces a drier rot than the other species and has a sharp boundary between healthy and diseased tissue. Affected tissue often appears as tunnel-like protrusions.

Note: **Gangrene**, often confused with dry rot, appears as a black rot with a sharp margin between healthy and affected tissue. Thumb print indentation and black pustules are often seen on the surface of rotted area.

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