Potato Storage diseases

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Potato storage diseases

				Source of the pathogen		
+ assuming rotation of 5+ years			Disease	Seed	Soil ⁺	Other
			Gangrene	***	-	
			Dry rot	***	*	
			Silver scurf	***	(*)	
			Skin spot	***		
			Black dot	*	***	
			Watery wound rot	*	***	
			Blackleg	***	(*)	?
			Soft rot	*	***	2



Gangrene





Gangrene

- Main cause of gangrene is Phoma foveata
- This is the most aggressive form which causes deep lesions
- However, there are similar fungi that can be described as 'weak' pathogens and give similar symptoms
 - Phoma exigua
 - Phoma eupyrena
 - Cylindrocarpon spp.



Gangrene



Other 'Gangrene' symptoms

 The lesions are usually shallower and slow growing Sometimes infection occurs via the lenticels giving a symptom called 'Pit rot'



Pit rot – infection through lenticels





Gangrene spores



Flask-shaped pycnidia

 Each pycnidium releases millions of small spores





The seed tuber is the main source of the disease for the succeeding crop

- Seed tubers which have gangrene lesions
- Seed tubers with surface contamination of gangrene spores
- Gangrene spores do not survive across a rotation in soil (e.g. 5 years). Thus soil is not considered a source of the fungus
- However, spores will survive in dust in potato stores and can contaminate seed tubers



Gangrene control

 Always check seed for signs of disease prior to planting



Seed tubers are rotted by the gangrene fungus

- Seed tubers with gangrene lesions may or may not emerge
- With surface contaminated seed tubers emergence is unaffected but seed tubers may subsequently rot
- Rotting seed tubers release billions of spores into the soil
- The spores spread to daughter tubers at harvest passively in water
- The fungus can grow up stems and, particularly after stems die rapidly invade stem tissue above ground. They produce pycnidia and release more spores which can contaminate daughter tubers at harvest



After planting tubers with gangrene lesions they rot down to release spores into the soil



After planting tubers with surface contamination they may rot down to release spores into the soil



Spread of spores after planting

- Rotting seed tubers release billions of spores into the soil
- The spores spread to daughter tubers
- The fungus may grow up stems and, particularly after stems die, rapidly invade stem tissue above ground.
- They produce pycnidia and release more spores which can contaminate daughter tubers at harvest



Rain splashes spores from an infected stem to healthy stems Rain washes spores into the soil to contaminate daughter tubers





The later the harvest the more spores contaminate the daughter tubers

BUT No damage no infection

 No matter how many spores contaminate daughter tubers, without damage infection is rare



Early harvest means less contamination of daughter tubers

Early harvest

- Less invasion of stems
- Fewer spores
- Warmer soils = faster wound healing
- Easier drying of tubers after harvest



Minimising damage at harvest



- Plenty of soil on the primary web
- Limited drop heights

Minimising damage at harvest

- Correct setting of cleaning systems
- Dahlman rollers
- Multi-sep rollers





For infection to occur

- Spores need moisture
- Rapid drying after harvest reduces infection

Optimum temperature for infection 10-15°C but infection can occur at low temperatures





Seed growers: Fungicide application on the harvester

- Applied on the Dahlmann rollers/ Multisep or at the top of the elevator when filling boxes – where tubers turn
- The on-harvester/into-store treatment is the best timing
- This treatment has saved some seed exporters from huge losses





Spores survive on the tuber surface

 Spores will survive on tuber surfaces and can infect if damage occurs e.g. at grading

Gangrene is a latent disease

- Time from infection to symptom expression is long – c. 2-4 months
- Storing tubers at very cold temperatures (e.g. 0-2°C) increases disease
- Hot boxing a sample can enhance symptom expression



Seed growers: It is important to:-Minimising damage at grading Minimise spread of spores on grader



Grading: Removes rotted tubers but can spread spores to healthy tubers and can result in damage and more gangrene



Minimise damage on the grader

- Reduce drop heights
- Maximum drop
 20cm
- Or use rubber cushioning



Pick off rotten tubers early in the grading process

This reduces spread of spores



After grading a stock with moderate or severe rots – clean the grader

- Remove encrusted soil
- Wash belts and webs with a disinfectant solution
- Power wash riddles
- Spray with disinfectant
 - Best disinfectants are:
 - Peracetic acid > quaternary ammonium > iodine >>> phenols

Cleaning grader after a diseased stock

 Current recommendation is to spray with 3-5% solution of peracetic acid just wetting all surfaces

Use of fungicides to control gangrene

- Where risk of gangrene:
 - Treat seed tubers pre-planting with effective fungicide
 - Treat on harvester/into store
- Fungicide options in UK
 - Imazalil (no resistance)
 - Thiabendazole (no resistance)
 - [Fludioxinil (no resistance)]

New rotary fungicide applicator





Summary of control of gangrene

- Determine the susceptibility of the variety to be grown
- Plant healthy seed
 - Visual inspection before planting
 - Apply seed tuber fungicide if required
- Harvest as early as possible if seed was infected prioritise harvest
- Minimise damage at harvest
- Ventilate to dry as soon as lifted
- Keep dry until primary wound healing complete
- High risk seed crops, apply fungicide at harvest/into store
- Hot-box samples to check infection
- Seed growers
 - Avoid damage at grading
 - Pick off rots early
 - Clean grader after a diseased stock
 - Carry out good hygiene, including suppressing dust

Pit rot has become a major issue in Scottish seed production

- Caused by weak 'gangrene' organisms
- Symptoms usually appear after Christmas
- Lenticel infection
- Linked to variety & method of haulm destruction
- Pulverised crops have limited pit rot





Pit rot and haulm destruction method



C=Carfentrazone-ethyl

J=Jet 5

Evaluating the Impact of Haulm Destruction Method on the Development of Disease in Seed Tuber Production. AHDB Potatoes Research Report R453 2013

Gangrene and haulm destruction method



Evaluating the Impact of Haulm Destruction Method on the Development of Disease in Seed Tuber Production. AHDB Potatoes Research Report R453 2013

Pit rot

- Flailing reduces stems infected by Phoma
- There is a suggestion that pit rot is worse where diquat is applied to a vigorous green crop


Dry rot - Fusarium





http://212.201.100.117/storage/Fungi/Hyphos/FusariumGerlachNirenberg82/web/GerNi82-95.gif

Dry rot - Fusarium



Fusarium Dry Rot

- Main pathogens
 - Fusarium coeruleum
 - Fusarium sulphureum
 - Fusarium sambucinum
 - Fusarium avenaceanum
 - And others





Same variety – different dry rot symptoms



Dry rot in Scotland

- Problem in Scotland linked to a few susceptible varieties
- Main pathogen is *Fusarium* caeruleum
- Once established in a stock of potatoes, it can be difficult to eradicate









Sources of dry rot

- Infected tubers
- Tubers with surface contaminated by spores
- Soil-borne spores (short rotations)





Contamination of daughter tubers

- Infected tubers rot down and spread spores to daughter tubers
- Non-emergence can occur with infected tubers
- Contaminated tubers will emerge but tubers may rot down and spread spores to daughter tubers
- Daughter tubers may be contaminated from soil-borne inoculum

BUT No damage no infection

 No matter how many spores contaminate daughter tubers, without damage infection is rare



Fusarium soil population studies



Optimum temperature for infection 20°C+

- Fusarium spores seem to increase early and decline subsequently
- Later harvest may reduced risk of infection
- Later harvest in cooler conditions means less ideal conditions for infection

Minimise damage on harvester and grader



Dry rot is a latent disease

- Time from infection to symptom expression is long – c. 3-4 months
- Symptom expression is temperature related
- Hot boxing a sample can enhance symptom expression
- There is a simple tuber test than can predict rick of dry rot

Fusarium dry rot test after harvest





Nielsen & Johnson (1972) Seed potato contamination with Fusarial propagules and their removal by washing. American Potato Journal 49, 391-396

Use of fungicides to control dry rot



- Where risk of dry rot or dry rot present in a stock of potatoes:
 - Treat seed tubers pre-planting with effective fungicide
 - Treat on harvester/into store
- Fungicide options
 - Imazalil (no resistance)
 - Thiabendazole (resistance with some species)
 - [Fludioxinil (no resistance)]

Summary of Fusarium dry rot

- Determine the susceptibility of the variety to be grown
- Plant healthy seed
 - Visual inspection before planting
 - Apply seed tuber fungicide if required
- Harvest later when soil cooler
- Minimise damage at harvest
- Ventilate to dry as soon as lifted
- Keep dry until primary wound healing complete
- High risk <u>seed</u> crops, apply fungicide at harvest/into store
- Hot-box samples to check infection or use dry rot test
- Seed growers
 - Avoid damage at grading
 - Pick off rots early
 - Clean grader after a diseased stock
 - Carry out good hygiene, including suppressing dust

Bacterial rotting



 Bacterial soft rots caused mainly by Pectobacterium spp. (Erwinia spp)

Bacterial soft rots may enter store from blackleg plants



Watery wound rot – Pythium can cause a watery soft rot



Bacterial soft rots can occur through wounds and where tubers are infected by late blight



Unlike gangrene and dry rot, soft rots may be present at harvest and should be removed before entering storage



The main weapon you have against disease is ventilation to dry and refrigeration to cool the crop and limit further rotting



Dried soft rots pose very little risk of spreading disease



Check the level of rotting before grading

 Assess the level of rotting (dry or wet rots) in a box by looking at the surface



Judging risk with soft rots in boxes

Look at top surface of boxes to be graded

- <u>< 1 watery soft rot</u> picking off from the tippler face or exit from the hopper should restrict bacterial or fungal spread to acceptable levels
- 1 5 watery soft rots high risk of bacterial or fungal spread. With blackleg susceptible varieties, put more pickers at the tippler face or hopper exit. Some spread will occur but make big efforts to ventilate bags or boxes after grading to rapidly dry any surface moisture
- > 5 watery soft rots where possible avoid grading and return the affected boxes to a positive ventilation system

One rotten tuber across a grading line is still contaminating tubers after >600kg is passed over grader



Pick off soft rots early during grading



Store hygiene: Dust is disturbed mostly

Where forklifts travel

On the grading line



Where there is dust there are disease spores



Store hygiene - Reducing dust in stores

Keep hopper separated from other areas

Vacuum dust where forklifts drive

Atomisation of water at or near drop points and/or areas where forklifts are running

Dry steam

Extraction system



Store hygiene – keep down dust



Stopping dust spreading during grading



Dust suppression on the grading line with low volume water spray







General advice on control

- Know the susceptibility to diseases of each variety – assess disease risk
- Check seed for signs of disease before planting. Consider a fungicide seed treatment
- Early harvest reduces risk of most tuber diseases except dry rot
- Ventilate after harvest to dry; cool after curing and maintain dry
- <u>At grading</u>
 - Pick off rotted tubers early in the grading process to prevent spores contaminating other tubers and the grading line.
 - Identify the cause of rotting
 - Clean the grader after grading a diseased stock
- For stocks with disease present apply a seed tuber fungicide at grading – using an effective applicator
- Dry seed after grading
- Practice good potato store hygiene and dust control

Thank you for your attention

D Kiezebrink SRUC



Silver scurf








Black dot







Seed tuber fungicide options

Fungicide	a.i.	Form'n	Dose/t	BS/ SC	SSc	SSp	Ga	DR	BD
Gavel	100 g/l imazalil	SC	150ml		Red	Red	Red	Red	
Storite Excel	500 g/l thiabendazole	SC	80 ml		Red	Red	Red	Red	
Tezate 220 SL	200 g/l thiabendazole	SC	200 ml		Red	Red	Red	Red	
Maxim 100FS	100 g/l fludioxinil	FS	250 ml	\checkmark	Red				Red
Emesto Prime DS	20 g/kg penflufen	DS	1.0 kg	√/Red					
Monceren DS	12.5% pencycuron	DS	2.0 kg	√/Red					
RhiNo DS	60 g/kg flutolanil	DS	2.0 kg	√/√					
RhiNo	460 g/l flutolanil	SC	200 ml	√/√					
Rovral AquaFlo	500 g/l iprodione	SC	200 ml	Red					

BS = Black scurf; SC = Stem canker; SSc = Silver scurf; SSp = Skin spot; Ga = Gangrene; DR - Dry rot; BD = Black dot: Red = Reduction

