Potato Progress

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Silver Scurf and Black Dot Development on Fresh Marketed Russet Norkotah Tubers in Storage

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Introduction

Silver scurf, caused by *Helminthosporium solani*, and black dot, caused by *Colletotrichum coccodes*, are two serious diseases of fresh marketed potatoes. Both diseases cause “imperfections” on the surface of potato tubers, and where looks are almost everything, significant economic losses from resulting culls have occurred. Often these diseases appear similar, are therefore confused with each other, and can be found on the same tuber (Figure 1).

Until relatively recently, black dot was known for rotting the cortex of roots and promoting early senescence of potato foliage. More recently this fungal pathogen has been associated with Ranger Russet tubers where the skin was raised with necrotic tissue below, causing issues during peeling at the processing plants. This pathogen is now found associated with dark areas on the surface of smooth and russet cultivars used in the fresh market. Silver scurf, another fungal disease, was identified some time ago as being the causal agent of blemishes on tuber surfaces. While silver scurf is generally considered a storage problem and not an issue at harvest in russet cultivars, this pathogen has caused significant damage at harvest in smooth-skin cultivars.

Silver scurf damage can be most severe in cultivars following storage, and generally becomes more problematic with time. This fungus is capable of producing spores in storage, called conidia (Figure 1) that can move in the air of the plenum system and land on healthy tubers and cause new infections. These infections show up as “spots” over the surface of the tuber (Figure 1), and can ultimately grow together encompassing large areas of the tuber surface. Infected tubers look dirty and cannot be cleaned. As the length of time in storage increases, so does the risk of additional new infections from spores and further growth of individual infections. Reducing relative humidity and temperature in storage can reduce secondary spread but can also lead to other tuber issues such as shrinking.

Little is known about black dot development in storage. In contrast to silver scurf, this fungus does not produce spores in storage that allow for new infections. The black dot fungus does form small black sclerotia on the surface of tubers (Figure 2) and their formation is diagnostic of this disease. Again, this pathogen causes tubers to be culled due to the surface blemish it causes.

Due to the lack of information regarding black dot development in Russet Norkotah in the Columbia Basin, tubers were followed in storage during the 2011-2012 storage season for black dot development. Given that silver scurf was present as well, this pathogen was also followed.

Methods

Approximately 30 tubers were randomly selected monthly from 8 storages, beginning approximately 1.5 months after the beginning of storage. Tubers were washed and put into a plastic potato bag, placed into a potato box, and then stored in the dark at 70 degrees for 3 weeks. At weekly intervals tubers were lightly sprayed with additional water. Tubers were then individually observed for the occurrence of each fungal disease (incidence) and how much of the surface area was infected by either disease (severity). A sample at or just before harvest (Sept 1) was collected to determine incidence and severity of each disease at harvest.

Results

Black dot was observed in significant levels in 7 of 8 storages, silver scurf in 2 of 8 storages. Figure 3 displays the average incidence for both fungi over time across all storages. No tubers were observed to be infected at harvest by either fungus. However, by the first observation of tubers on Oct 29 (collected 3 weeks earlier), black dot incidence appeared at high frequencies (approx 28%) and while varied in subsequent sampling, returned to approx 25% at the last sample date in June when tubers were removed from storage. While a very low level of silver scurf was seen in November, a noticeable increase in incidence across the 2 storages with significant levels of silver scurf did not occur until late December. Higher disease levels continued through January and generally leveled off through the remainder of the storage season. By mid-way through the storage season all tubers in these two storages where infected with silver scurf.

Severity of the two diseases followed similar patterns (Figure 4). Black dot severity averaged across all 7 storages at approximately 1.75 percent of the tuber surfaces in October, and remained at about that level until tubers were removed from storage. Silver scurf severity increased in late December/early January and then increased again in late April.

Discussion

Spread of silver scurf in storage occurred as expected. The initial development of secondary infections (higher incidence) began appearing on tubers around the end of December to mid-January. An earlier study at Hermiston showed similar results to those seen here. Secondary infections came from spores either produced on a few infected tubers coming into storage and then spread in storage via the air system, or came from tubers contaminated at harvest from spores in the soil, produced on infected seed, stolons or daughter tubers during the growing season. By the end of storage, all tubers in two of the storages that contained silver scurf were infected and looked similar to the tuber in Figure 1C. Very little or no silver scurf was seen in the other 6 storages.

Silver scurf severity also increased with time and in these two storages averaged 12-17 % (data not shown) of the tuber surfaces infected at the end of the storage season. Interestingly, increases in silver scurf severity showed three apparent timings: 1) increase from the field, appearing in mid-January; 2) an increase through late April; and 3) a large increase at the last sample (Figure 3). The increase in the later part of the storage season was likely due to individual lesions growing together.

Why only two storages had issues with silver scurf is unknown but likely relates to one or maybe several issues. Control of silver scurf begins by planting silver scurf free seed, using a seed treatment that is effective towards this disease, maintaining at least a two year rotation (two years out of potato), and harvesting immediately after skins are set. Planting infected seed is most likely the reason for the high incidence in these two storages. Seed can be tested for the occurrence of silver scurf prior to purchasing to confirm level of infection. Seed treatments alone do not completely protect daughter tubers from infection particularly if potatoes will be stored for many months. Effective control of silver scurf relies on using all chemical and cultural methodologies.

The information on black dot was particularly interesting. While no black dot was seen on tuber surfaces at or near the beginning of the storage season, this disease suddenly appeared in the November sample, sometime between harvest and about 1.5 months following the beginning of storage. While the average incidence levels across the 7 storages that had black dot seemed to increase with time only to fall back to earlier levels (Figure 3), the changing levels found at each sampling time most likely was related to normal variation found between samples. Severity levels also were similar at the beginning of storage until tubers were last sampled in June. In other words, black dot appeared suddenly and the incidence and severity did not change over time. Black dot has no known way to spread in storage (conidia are adapted for splash dispersal and not readily carried in air currents) and apparently infected areas on the tuber surface do not significantly increase in size in storage. Further work is needed to confirm this observation.

When did the tubers become infected with black dot? The obvious conclusion is that tubers were infected prior to entering the storage and that the symptoms developed soon thereafter. Control of infection or symptom development would need to occur in the field or at harvest. At this time there is no known way to control tuber infection or symptom development but work is under way to help answer those questions.

Acknowledgements:

This work could not have been done without the dedicated efforts of Ellie Charvet, Harvest Fresh Produce Inc. Also, we would like to acknowledge the capable help of Jesika Holcomb.

Figure 1. Silver Scurf (A) Areas on this tuber are infected with both silver scurf(black spots on left) and black dot (large discolored area on Right); (B) Silver scurf conidiophores (stalk)with conidia (branches); (C) New silver scurf infections across the tuber from spores spread in storage.

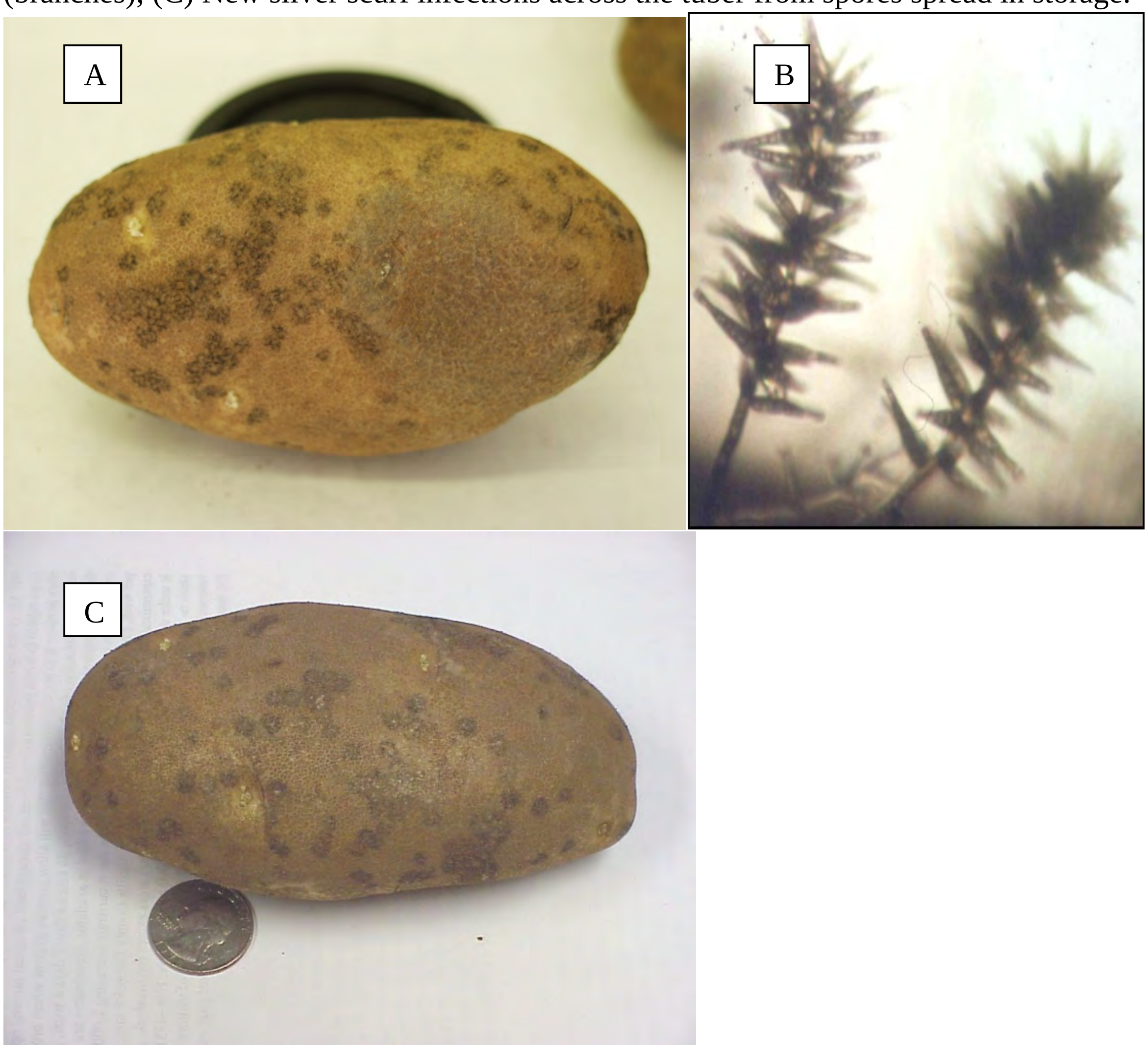


Figure 2. Black Dot (A) Black dot infected Russet Norkotah. Tubers are wet to better show the darker brown areas with typical infection; (B) close-up of the small dark sclerotia on the tuber surface that are diagnostic of this pathogen.

Figure 3. Black dot and silver scurf incidence over time. Dates are when tuber samples were observed (collections occurred approximately 3 weeks earlier).

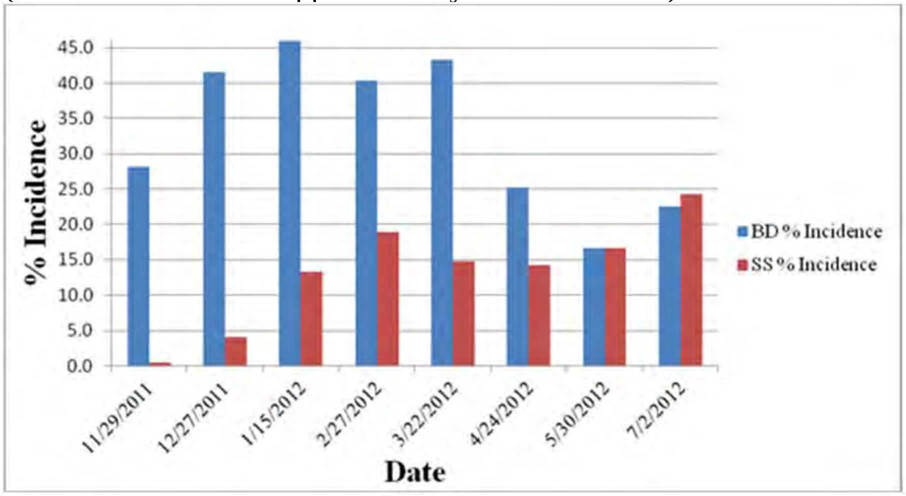
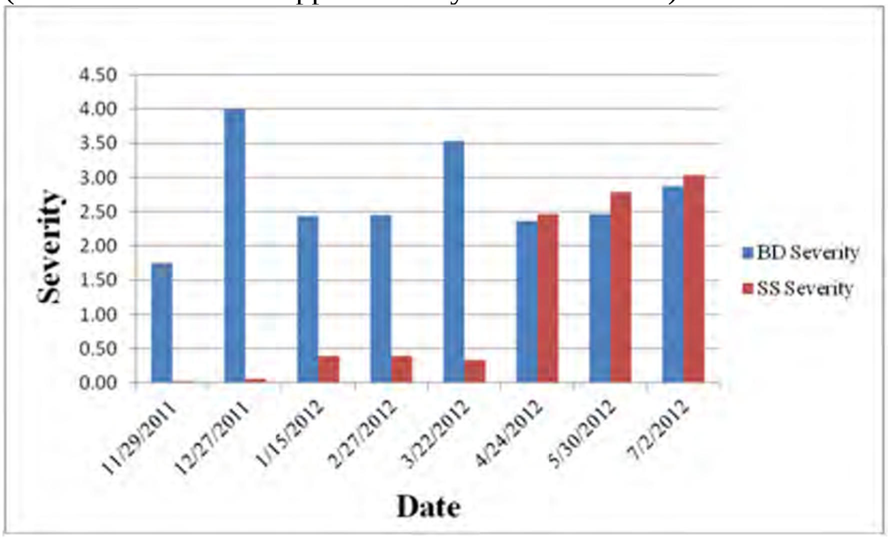


Figure 4. Black dot and silver scurf severity over time. Dates are when tuber samples were observed (collections occurred approximately 3 weeks earlier).



Checklist for Managing Late Blight-Infected Tubers in Storage

Dennis A. Johnson, Plant Pathologist, Washington State University

Late blight is present this growing season from north of Pasco to Moses Lake. Infected tubers are inevitably being harvested and placed in some storages. Following is a checklist for managing potatoes in storage that may contain late blight-infected tubers. These suggestions also apply for pink rot and Pythium leak. Additional information can be found at http://classes.plantpath.wsu.edu/dajohn.

1. Continue late blight fungicide applications until harvest or until all vines are dead.
2. Harvest only during dry weather.
3. Harvest when tuber pulp temperature is 45-65º F.
4. Store known infected tuber lots separate from non-infected lots.
5. Store known infected tuber lots where they can be easily obtained for processing.
6. Sort for rot going into storage –provide sufficient light and people to do the job.
7. Provide adequate air flow throughout the storage (25 cfm/ton).
8. Cool and dry the tubers as quickly as possible.
9. Cure tubers at the lowest temperature possible (50º F) or eliminate the curing period, depending on the amount of rot.
10. Cool the pile to the final storage temperature as quickly as possible – about 42º F for table stock, 45º F for French fry processing and 50º F for potato chips. It may be necessary to cool and hold tubers for processing and chips below the typically recommended temperatures.
11. Do not humidify.
12. Run fans continuously. Recirculation air through the tubers at all times, even when outside air is not being introduced.
13. Keep piles shallow to promote air movement and removal of hot spots.
14. Monitor storages daily. Determine temperature of the piles at various depths and locations. Serious late blight problems usually show up with 6 weeks of storage.
15. Do not expose cold tubers to outside air and any tubers to air at or below freezing.
16. Tubers of Alturas and Umatilla Russet are moderately resistant, and tubers of Defender are resistant. Storage problems with these cultivars should be less than with other cultivars. Ranger Russet tubers are very susceptible. Good air movement and temperature and humidity management will be needed when storing infected tubers of all cultivars.

Potato Late Blight

See also: http://www.nwpotatoresearch.com

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Tuber Late Blight

Tuber infection begins superficially, but can invade entire tuber. Sporulation can occur on cut or uncut tubers.

J. Gigot, WSU-NWREC

Management

1. Prevention is key
2. Harvest during dry weather
3. Tuber temperatures going into storage should be less than 68 F
4. Mancozeb and metiram fungicides on the soil surface late season may help prevent tuber infection
5. Foliar applications of phosphorous acid at harvest and in storage can reduce late blight tuber rot
6. Late blight infection often leads to other kinds of tuber rots in storage -- it is best to NOT STORE late blight infected potatoes, and there are no chemical treatments that will cure an infected pile of potatoes

General Information

Causal Agent: *Phytophthora infestans*

Biology: Pathogen of potato and a few related plants; infection encouraged by humid and wet conditions

Dispersal: Sporangia move in the wind; zoospores in water

Fungicide resistance: *P. infestans* is well-known to become resistant to site-specific fungicidesused against it. Fungicides should be rotated frequently to prevent resistance.

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