Understanding and Managing Potato Tuber Diseases

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There are a number of potato tuber diseases that cause real problems for potato producers. Some of them can be managed relatively easily while others are much more challenging and some are so poorly understood that management guidelines have not yet been formulated. In this article we’ll examine several of these diseases and the current state of our knowledge for managing them.

**Silver scurf.** Silver scurf of potatoes is a problem that seems to have leveled out in the potato-producing areas of the US and Canada over the last several years. Still, losses associated with the disease can be substantial. Information from a University of Idaho survey of fresh packers indicated that this disease cost the Idaho industry over 8.5 million dollars in the 92-93 season, with some 2 million cwt. rejected for fresh pack use. A later survey (1994-95) set the tab at somewhere between 3 and 4 million. One major difficulty with silver scurf is that the disease is usually not visible until the crop has been stored for several months and, by the time the problem is seen, disease spread can be pretty extensive.

**Symptoms.** The disease is caused by a fungus called *Helminthosporium solani*. The fungus infects and spreads in the periderm (skin) of the potato where it produces irregular silvery patches on the skin of the tuber that vary from pinhead size up to patches that cover most of the tuber surface. These lesions usually remain superficial with no internal damage to the tuber. However, severe symptoms, where the infected cells of the periderm and underlying cortex collapse and allow moisture loss, occur regularly. The fungus has traditionally been reported to be strictly seed-borne but researchers have recently determined that it probably can survive for at least a year and possibly more in the soil.

In the early stages of the disease, the scurf fungus moves from infected seed pieces to daughter tubers while the potatoes are still in the soil. Exactly when these infections take place is unknown but daughter tubers have shown evidence of the disease as early as 6 weeks after planting. Other work indicates that the disease spreads greatly during periderm maturation, just prior to digging.

This stage of the disease which occurs on tubers while they are still in the ground is referred to as the "primary infection" which results in "primary lesions." These lesions are the fairly thick and prominent patches that are usually more severe on the stem end of the tuber. Field infections where there are no visible symptoms also occur regularly.

The primary lesions and other field infections provide inoculum, in the form of fungal spores, for secondary spread of the fungus from infected to healthy potatoes within the storage facility. This cycle of infection leads to "secondary lesions" which are, individually, less severe than the primary lesions but may force a particular lot of potatoes out of grade by the weight of sheer numbers. The speed with which silver scurf spreads and establishes inside the storage can be greatly influenced by storage management practices, including both curing and holding conditions.
University of Idaho research indicates that the silver scurf fungus may be able to survive from the end of one storage season to the beginning of the next on materials such as wood, sheet metal, insulation (polyurethane) and even in soil from the cellar floor.

**Recommended control measures for silver scurf.**

1. Use a seed piece treatment that is effective for silver scurf. Seed is a significant source of silver scurf inoculum and seed piece treatments can greatly reduce fungal sporulation on the seed piece and subsequent spread from seed piece to daughter tubers. Seed producers take note: Careful attention to seed production practices can help reduce the potential for scurf development in the seed crop. Storing early generation seed lots separately from older generations can reduce the amount of spread from older into younger generation materials, for instance.

2. Do not plant potatoes immediately into fields that had silver scurf the previous year. It is not known for certain how long the fungus can survive in soil, but recent reports indicate that it may be able to survive on the debris of cereals and alfalfa for a year and possibly longer.

3. The longer tubers remain in the soil after maturation, the more likely they are to become infected if the disease organism is present. Harvest tubers as soon after maturation as possible to limit the time the tubers may be exposed to the pathogen. If potatoes have visible signs of silver scurf, they may need to be utilized early before the disease has a chance to progress further.

4. In storage, avoid conditions that may lead to condensation or free moisture inside the structure. Before loading, storages should be cleaned and disinfected thoroughly. Provide adequate time for disinfecting, make sure to wet the storage surfaces well. Then open and dry out the storage before loading potatoes.

5. Monitor your stored crop frequently to see if a scurf problem is developing. Early marketing, while not the most desirable alternative, may at least allow the producer to get a decent price for his crop.

**The Water Rots: Pink rot and Pythium leak.** - Tubers that have water rot have a bloated, waterlogged appearance and will often be dotted with white tufts of fungal growth. There are actually two different types of water rot: pink rot and Pythium leak, and each is caused by a different fungus.

**Pink rot.** - Probably the most prevalent of the two water rots is pink rot caused by *Phytophthora erythroseptica*. This disease can be found in the field before harvest and is characterized by rotted tuber tissues that turn pink after exposure to air for twenty to thirty minutes. Another important diagnostic trait for pink rot is that the rot will usually appear to start from the stem end of the tuber and will then progress through the tuber in a very uniform manner, often with a nearly straight line between the healthy and the diseased portions of the tuber. Pure pink rot is not a slimy soft rot but infected tissues are easily, and often, invaded by soft rot bacteria which will cause this symptom. In a tuber that is infected with the pink rot fungus alone, the rotted tissues will still retain some structure and firmness but not nearly as much as the healthy portions
of the tuber. The texture of the infected tuber tissue is much like that of a boiled or "cooked" potato.

**Pythium leak** - The other water rot is Pythium leak, often referred to as simply "leak." This disease is caused by fungi of the genus Pythium and may be either *P. debaryanum* or *P. ultimum*. The *Pythium* and *Phytophthora* genera are closely related and belong to a class of fungi known as the "water molds." This group also includes the late blight fungus, *Phytophthora infestans*, although the disease cycle for late blight is much different than either pink rot or leak. Leak is characterized by a rot that starts from an infection site on the surface of the tuber and generallyrots out the entire central portion of the tuber while leaving the portion of the tuber from thevascular ring out to the skin of the tuber intact. This results in a condition that is aptly described as "shell rot." The rotted tissues are brown to black in color and may have cavities within them. The texture of the rotted tissues is much softer and more slimy than the "cooked potato" texture described above for pink rot. When a diseased tuber is squeezed a clear fluid can be readilyexpressed from the damaged tissues. This is the origination of the name "watery wound rot,"another name for leak. Like pink rot, the diseased tubers can be easily invaded by bacterial softrot.

**Disease cycles** - Both of these fungi are soilborne and can survive for long periods of time in the soil. This disease cycle for the two diseases is somewhat different, however. Pink rot infections are usually associated with wet conditions, low spots in the field, near wheel tracks or simply in overwatered areas. Infections occur in the soil through the lenticels or through the stolons of the tubers. This disease can rot a tuber very quickly, usually within just a couple of weeks. Pink rot studies at North Dakota State University indicate that infection of wounds made during harvest and handling can also occur. Usually pink rot involves only the tuber but symptoms of the aboveground portions of the plant sometimes occur. Infected plants may wilt, with the leaves becoming chlorotic and eventually drying up and falling off. Sometimes aerial tubers will form as well.

In contrast, Pythium invades the tuber wounds that occur during harvest, especially when tuberpulp temperatures are high. Wounds are necessary for the Pythium fungi to infect. Because of this requirement, Pythium is seldom found in the field before harvest like pink rot. Pythium can be responsible for seed piece decay in cut seed if conditions are warm and wet immediately afterplanting. There are no vine symptoms associated with Pythium leak.

**Soft rot problems.** - With both pink rot and pythium there is a very real danger that diseasedtubers will succumb to the soft rot bacterium after the tubers have been stored. Neither of thetwo fungal diseases appears to move appreciably from tuber to tuber within the storage, but softrot, which readily invades tubers infected with either disease, can move quite easily and rapidlyin the storage. Storage management procedures may need to be modified to take this intoaccount.

We do not know of any assay procedure that can predict the potential for pink rot or Pythiumleak in a given field. The best guideline for making chemical application decisions is knowledgeof the history of water rot problems on a particular circle.
Field Management Guidelines for Water Rots.

1. Water management (avoid overly wet conditions).

2. Tuber pulp temperatures below 60 F.

3. Do not harvest problem areas

4. Bruise management during harvest and handling.

5. Mefanoxam application.

**Pink eye.** - Pink eye is characterized by, as the name implies, a wet, pink discoloration of the eyes but closer inspection of infected tubers will often reveal the same pink discoloration of the periderm between the eyes on affected areas. The overall effect is wet-looking, pinkish patches on the tubers that include both eyes and areas of the periderm between them.

In some parts of the country, a small percentage of the tubers can become infected with a soft rot that starts at the bud end of the tuber. This problem is all but identical to tuber black leg except that it originates from the bud end rather than the stem end of the tuber. It is no surprise that the symptoms are very similar since both problems are caused by the soft rot bacterium. Pink eye-infected tubers examined in windrows during the 1998 harvest in Idaho showed very early stages of the bud-end rot. The rot appeared to be invading the tuber through a bud-end eye within a pink eye-infected area.

Pink eye is usually most prevalent during harvest and immediately after. With proper ventilation, often the pink discoloration will all but disappear within a week or two after potatoes have been stored. In some cases a more serious defect occurs. The periderm over the affected areas can become thickened and prominent during several months in storage, producing a symptom that has been referred to as “corky patch” or “bullhide”. These corky patch areas will often wind up looking a lot like silver scurf. In fact, the silver scurf fungus has sometimes been isolated from what were pink eye-infected areas of the tuber but the black dot fungus has also been found associated with areas having the same symptom. These bullhide areas can be a serious problem for processors due to the inability of steam peeling to remove affected skin tissues resulting in external defects.

What causes pink eye? Good question. Pink eye is a disease that is only poorly understood and the definitive causal organism (s) and, indeed, the optimum environmental conditions remain unknown. There are several causal agents that are linked to the disease including a bacterium called *Pseudomonas fluorescens* and fungi like *Verticillium*, and *Rhizoctonia*. Naturally, this lack of information makes management recommendations very difficult.

One environmental condition that does seem to be a constant in regard to pink eye is that the affected potato crop received excess water late in the season especially if coupled with higher than normal air and soil temperatures earlier in the season. Fortunately, pink eye only seems to show up infrequently and thus is only an occasional problem.