

Recognizing and Managing Tubers Diseases to Look Out for at Harvest:

Bacterial Ring Rot, Pink Rot and Pythium Leak.

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Bacterial Ring Rot

Bacterial Ring Rot of potato (BRR) is a vascular pathogen that is characterized by a foliar wilt and a rot that affects the vascular ring in the tuber. Often the first symptom observed in the field is the sudden wilt of a single stem on a single plant, a symptom referred to as "flagging," though the wilt can also affect the entire plant. Some varieties suffer from shortened internodes and mild chlorosis (yellowing) in the upper part of the plant, a symptom referred to as "dwarf rosette." Tuber symptoms range from a slightly yellow discoloration of a portion of the vascular tissues to the complete deterioration of the vascular ring. Secondary invaders such as bacterial soft rot can rot out the entire center portion of the tuber, leaving behind a hollow shell consisting only of the intact tissues from the vascular ring outward. Surface cracking on tubers is frequently but not always observed as well. In both infected stems and infected tubers, the vascular tissues become clogged with large numbers of the BRR bacterium and squeezing the tuber or stem to look for "bacterial ooze" is a field diagnostic technique that is used routinely. Because foliar wilt and vascular discoloration can be caused by diseases or conditions other than BRR, a laboratory test for confirmation is highly recommended.



Figure 1. Symptoms associated with Bacterial Ring Rot (BRR) of Potato. A. Potato plant infected with BRR displaying foliar wilt, chlorosis and stunting. B. "Dwarf rosette symptom of BRR seen in some varieties. C. Tubers showing surface cracking typical of BRR. D. Tuber showing deterioration of the vascular tissues caused by BRR infection.

Dissemination of BRR.

Unfortunately, the disease can also be present and remain symptomless, a condition referred to as "latent," which is one of the reasons that BRR can be so difficult to recognize in the first place. Most BRR spread occurs during seed cutting, a process that exposes the vascular tissues

of both healthy and infected tubers. When an infected tuber is cut, the blades of the seed cutter become contaminated with the BRR organism and the vascular tissues of healthy tubers, subsequently cut with the contaminated blades, become exposed to the bacterium. Unfortunately a large number of healthy tubers can be exposed before the contamination is finally diluted out. Spread on the cutter is the primary method by which the disease increases to problem levels on commercial potato farming operations and a low percentage of disease in a contaminated seed lot can increase to alarming and economically damaging levels during cutting. Often the magnitude of the problem only becomes apparent late in the growing season or while the crop is being harvested.

Field management of BRR for affected commercial growers.

If BRR has been confirmed in a commercial field, it is recommended that the field be harvested last. This procedure will provide time for badly infected tubers to completely deteriorate and for other infected tubers to develop symptoms that are more easily observed and therefore easier to remove before potatoes are placed in storage or processed. The disinfection procedures outlined below should then be performed on all potato equipment to avoid contaminating seed brought onto the farm the following year.

Cleaning and Disinfection Guidelines.

It is important that proper protocols for cleaning up after a potato bacterial ring rot (BRR) outbreak are understood and followed completely. Utilizing these protocols can help ensure that any bacterial contamination that could affect future crops is eradicated completely from a farming operation. **There are no shortcuts when dealing with BRR, the approach to eliminating this disease must be aggressive and thorough and involves sanitation practices that go far beyond what is considered to be normal clean up procedures.** On the plus side, many farming operations have successfully executed a sanitation program after a BRR outbreak and have since remained free of the problem.

Here are some important points to consider for the execution of a successful BRR eradication program:

1. A thorough clean up and disinfection of storage facilities and any equipment that has been used to handle or transport potatoes. This means all equipment, tractors and trucks included. No exceptions.
2. Disinfection is a three-stage process and should adhere to the following guidelines:
 - a. **Thoroughly clean up all potato debris, soil and other physical contaminants** in the storages, on equipment and on the premises. In addition to basic tools like a broom and shovel, this step can and should include the use of steam or pressure washers.
 - b. **Thoroughly wash all newly cleaned surfaces with hot water and detergent.** The BRR organism can survive for long periods in dried deposits of contaminated potato sap or dried bacterial slime and the hot water and

detergent wash will help to dissolve these reservoirs of bacterial contamination. The detergent wash actually begins the process of chemical disinfection.

- c. **Thoroughly apply a disinfectant solution to all surfaces and continue to apply the disinfectant, if necessary, until the surfaces being treated have been wet with the disinfectant solution for at least ten minutes.**
3. It may be necessary to partially dismantle some of the harvesting and handling equipment to properly disinfect items like rubber belts, rollers and other mechanical parts. Equipment should be washed and new grease injected into fittings before a second wash is performed prior to disinfection.
4. Porous surfaces such as wood or fabric are extremely difficult to properly disinfect. Wood should be replaced, preferably with a substitute material that can be more readily disinfected or, at the very least, painted over with high quality epoxy paint.

Throughout the clean-up and disinfection process remember that attention to the smallest detail is extremely important. The bacterium can persist for long periods of time in the relatively stable conditions of a potato storage and can hide readily in the many nooks and crannies encountered on a potato farm. For example, BRR can survive on hard surfaces for up to 3 years and up to 7 years on wood surfaces. Therefore, BRR contamination can become a perennial problem if not adequately cleaned. See CIS 1180 "Cleaning and Disinfecting Potato Equipment and Storage Facilities" by the University of Idaho at www.kimberly.uidaho.edu/potatoes for additional information.

Pink Rot

Tubers affected by pink rot, caused by *Phytophthora erythroseptica*, often maintain a normal shape, but the outer skin turns dark and, upon cutting, the internal flesh has a rubbery, "boiled potato" consistency. The internal tissue will also turn a pink color after about 15-20 minutes of exposure to warm air and approximately 30 to 40 minutes under cool temperatures (Figure 2A). It is easy to confuse the pink rot color reaction with the lighter pink color that occurs due to oxidation when healthy tissue is exposed to air. Look for a distinct line between healthy and infected tissue. Your nose can also help in diagnosing this disease. Pink rot in storage is usually accompanied by a distinctive ammonia odor.

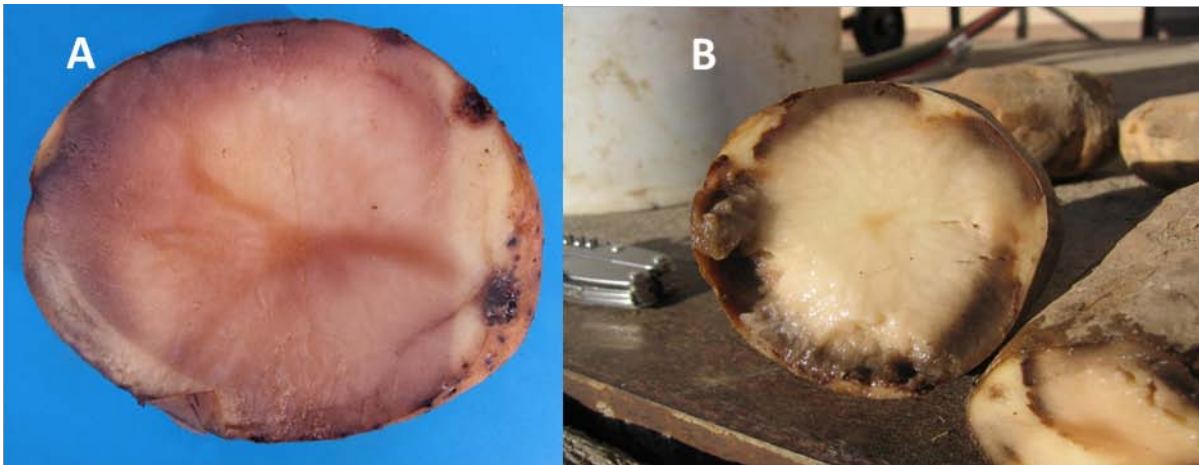


Figure 2. Symptoms associated with Pythium leak and pink rot of potato. A. Cross section of a potato tuber with pink rot infection showing the characteristic pink discoloration typical of the disease. B. Cross section of a potato plant tuber with Pythium infection showing deterioration of the tuber tissues from the vascular ring inward.

Pythium Leak

Pythium leak, caused by *Pythium* spp., is often described as a “shell rot”, but the term “leak” comes from the extremely wet nature of the rotted tissues. One method to confirm the presence of leak is to gently squeeze the rotten tuber and watch for a clear liquid to stream from the tuber. This disease also tends to cause a grey/brown/black colored rot in the interior of the tuber, leaving the outer cortex or “shell” of the tuber intact (Figure 2B). Since the leak pathogen typically needs a wound to infect, inspect the tuber for any potential disease entry points.

Early Storage Management for Pink rot and Pythium leak

If potatoes are harvested with pulp temperatures above 60°F, cool to at least 60°F within the first 2 to 3 days after harvest, while allowing for maximization of fresh-air intake duration. This is especially important for tubers with pink rot, Pythium leak and soft rot, since warmer temperatures promote a faster rate of decay. Supply a high volume of air to the potatoes to decrease the temperature and to help dry out rotted or wet potatoes. Set-point temperatures may need to be decreased in a stair-step manner to optimize the duration of fresh air intake per day. Ventilation system operation should be initiated as soon as the first two to three ducts are covered in the loading process. Continue to decrease storage temperatures to the desired curing temperature.

See CIS 1131 “Diagnosis and Management of Potato Storage Diseases” by the University of Idaho at www.kimberly.uidaho.edu/potatoes for additional information.