

RECOGNIZING AND MANAGING BACTERIAL RING ROT

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Bacterial ring rot of potato (BRR) is caused by the bacterium *Clavibacter michiganensis* subsp *sepedonicus*. The disease was first reported in the U.S. in the 1930's and has been managed pretty well, especially for the last ten or fifteen years, with rigid seed potato certification regulations. While BRR has not been a particular problem in Idaho seed or commercial potatoes since the adoption of a state seed law in the mid 1990's, this disease has been reported from several U.S. production areas recently.

BRR SYMPTOMS

Foliar symptoms: The bacterium is a vascular pathogen, so one of the primary foliar symptoms is a wilt. The wilt will often involve only one stem of an infected plant and the affected stems may recover, at least initially. As the wilt gets worse, an upward rolling and marginal necrosis of the leaves will appear. In some varieties, like Russet Burbank, the internodes in the upper part of the plant do not elongate properly and a sort of "dwarf rosette" symptom may appear. Another foliar symptom is the production of bacterial slime or "ooze" in the vascular tissues that can be forced out of a stem that is cut and squeezed.

Tuber symptoms: Infected tubers often have external cracking and a vascular symptom that ranges from minor yellow discoloration to complete destruction of the vascular ring. Often the same type of bacterial ooze found in infected stems can be expressed from the infected tubers as well. Infected tubers may also have no visible symptoms at all, something referred to as a "latent infection." The frequent occurrence of these latent infections is one of the reasons that the disease can be spread so easily – no one is aware that it is present.

Disease spread: Within an infected seed lot, the disease moves primarily during the process of cutting seed tubers. As outlined in the previous section, the bacterium lives in the vascular tissues of foliage and tubers so the process of cutting infected tubers will serve to contaminate the cutting machine at the same time that it exposes the vascular tissues of healthy tubers to BRR invasion. Disease spread can be pretty extensive during cutting and an increase in disease from a minor problem to a major one can readily occur.

BRR moves from farm to farm almost exclusively in seed potatoes, but contaminated equipment such as truck beds, seed cutters, and seed handling equipment have been shown to be the source of infection for some outbreaks of the disease. Fortunately, the bacterium doesn't survive in soil from one season to the next, but volunteer potatoes could harbor the disease.

Probably the major reason that BRR shows up unexpectedly is, as outlined above, the frequent occurrence of latent infections, which could allow the disease to go unnoticed, even if standard seed production and inspection procedures are followed. Another concern is that not all seed certification agencies have the same inspection requirements, particularly when it comes to shipping point inspections and winter test requirements. At the very least, a shipping point inspection should be performed, but there are other, more rigorous steps growers can take to protect themselves.

WHAT TO DO IF YOU GET BRR

Field recommendations: Harvest fields with known BRR infections last. This practice allows time for infected tubers to rot away or to be readily recognizable during handling and storage loading. Cull out suspected BRR tubers.

Storage recommendations: Long term storage of infected potatoes is not without risks. BRR-infected tubers will often go down with bacterial soft rot infection. Manage the ventilation as you would for a soft rot infection. Low storage temperatures, if feasible, will slow the rotting process and allow for longer storage.

General farm recommendations: Get rid of all potatoes on the farm. Make sure to clean up all potato debris as well as wash and disinfect all surfaces in the storage facility. Clean and disinfect all farming equipment such as harvesters, windrowers, cutters, conveyors and other handling equipment. Don't forget the truck beds! Start with new, clean seed potatoes the following season.

Seed producer concerns: BRR may be the most difficult of the seed-borne diseases to deal with for seed producers. One reason for this difficulty is that BRR is a "zero tolerance" disease. This means that a single positive plant in the field or tuber in the cellar means the immediate rejection of the seed lot the sample came from. In Idaho, and many other states, it also means that every seed lot on the farm becomes ineligible for recertification and the affected grower must move out all seed of all seed lots, clean up and disinfect all equipment and buildings and, finally, obtain all new seed for the following year. These hardships, along with the loss of reputation associated with BRR, can be devastating for seed growers.

Protection: In order to effectively protect your farm from this serious pest, we recommend that growers who are importing seed into Idaho and are concerned about possible BRR contamination should request both a physical inspection (shipping point inspection) with samples taken from each truck load and laboratory testing of at-risk seed lots to minimize the chances of bringing BRR onto their farm.

The shipping point inspection is absolutely vital. Check to make sure that this inspection is being carried out on seed potatoes that you buy. In most U.S. states there is a third party inspection by Federal / State Fresh Fruit and Vegetable Inspection Service on a sample taken from each truck load shipped. Certification agencies outside of the U.S. may not require this inspection. During this inspection potatoes are cut and visually

examined for symptoms of bacterial ring rot (and other diseases) and any suspect tubers are tested by the state's certification agency. However, BRR can very readily be present but symptomless (also known as "latent") so we are suggesting that a laboratory test such as ELISA or immunofluorescence (IFAS) be performed on at-risk or suspected seed lots. Of the two tests, IFAS is generally considered to be more sensitive than ELISA.

To perform these laboratory tests, 400 tubers are randomly collected from the storage. The laboratory removes a cone of tissue from the stem attachment point of each tuber. This area is where the vascular tissue bundle is found, and where the bacteria, if present, will be concentrated. The tissue plugs are then combined and tested by IFAS or by ELISA. The IFAS test causes the bacteria to appear bright green under fluorescent light and it is a very sensitive and specific test. ELISA is also a good and effective test for bacterial ring rot. Generally these tests can be performed for less than \$200.00 making the procedure very cost-effective.

The future: At the current time, we aren't sure whether BRR is on the increase in the U.S. or not. Certainly there have been a number of changes in the seed potato industry over the last ten or twelve years. It may be that a periodic re-evaluation of how we manage this disease as an industry is a good idea.