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Understanding Bacterial Ring Rot in Potatoes

Over the past two decades, Alberta has developed an excellent reputation for producing high quality, healthy seed potato stocks (Figure 1). Annual losses from bacterial ring rot (BRR) in our commercial potatoes are minimal or non-existent.



Figure 1: Russet Burbank – a quality gem

All seed potatoes in Canada undergo rigorous testing for this highly infectious disease, as required under federal seed regulations. If the disease is found in seed potatoes, current regulations state that all seed lots on that seed farm or farm unit will be decertified in that year.

Background

The bacterium responsible for BRR normally multiplies only inside stems, stolons and tubers of potatoes. BRR bacteria can exist for weeks, months or even years outside of a host, in dried infected pulp and pathogenic mucilage. It can be smeared on sacks, crates and storage walls. BRR can also survive in dried tubers for a year or more.

The ring rot bacterium does not overwinter in fields from season to season unless infected volunteer tubers survive. The bacterial ooze that can be squeezed from infected stems or tubers

(Figure 2) contains millions of pathogenic bacteria. This ooze can be diluted a million times and still infect healthy, susceptible potatoes. One infected tuber passing through a seed cutter can infect hundreds of healthy tuber pieces.



Figure 2: A ring of bacterial ooze

Despite rigorous seed testing and a low incidence of BRR in commercial fields, the disease continues to occur throughout the world's potato industry. It is reasonable to question why BRR persists at low levels.

Potato cultivars such as Urgenta, Desiree or Teton are highly resistant to BRR and rarely, if ever, show symptoms of disease when infected. There is, therefore, a risk of symptomless infections occurring in these cultivars, and they have been shown to act as carriers of the disease. For example, Russet Burbank is partially resistant and does not always show symptoms of the disease during the first year of infection. Infected tubers of Sangre, again somewhat resistant, look healthy at harvest, but BRR bacteria can multiply internally during storage. These same tubers, which retain their shape and appear healthy, can be a major source of infection during seed cutting operations. The cultivars, Norchip, Norland and Red Pontiac are highly susceptible and develop typical symptoms of BRR in stems, leaves and tubers (Figure 3).

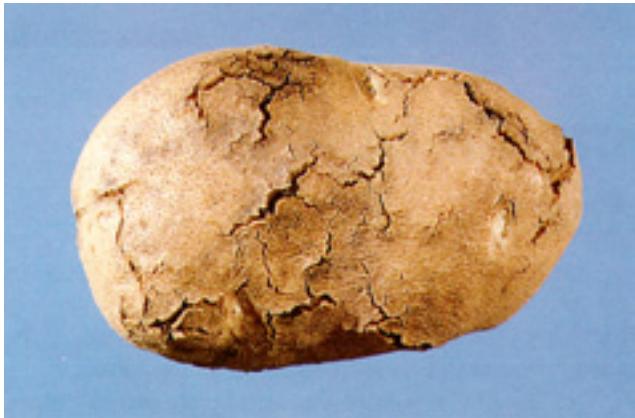


Figure 3: Cracked, heavily infected tuber

Infected tubers of these and other susceptible cultivars almost always rot or shrivel rapidly in storage. A five per cent BRR infection of tubers may result in the total loss of the entire harvested crop during storage.

How is BRR spread?

BRR is usually only a problem where tubers are cut into pieces prior to planting. In countries where whole, small tubers are used for seed, the disease is usually non-existent; however, it is still seen as a significant threat to their potato crops. The more cuts per tuber, and the more that cut tubers are mixed together, the higher the chance of BRR spreading from seed piece to seed piece. One infected tuber can spread the bacteria to hundreds of healthy tuber pieces during cutting and handling operations.

Inadequate cleaning or disinfection of cutters, handling equipment, storages and common handling areas between lots of potatoes can also result in contamination from one lot to another.

Why does BRR continue to occur in North America?

There are many reasons why bacterial ring rot continues to persist in North America's potato industry.

- Seed cutting remains a common practice.
- Low levels of infection are spread by inadequately disinfected seed cutters.
- Contaminated seed tubers brought to a seed farm from another region or from another seed farm may escape BRR detection if there are substandard testing requirements elsewhere.

- Infection levels of BRR bacteria on varieties such as Russet Burbank may be so low that disease symptoms do not develop, and proper sampling with modern diagnostic techniques will not detect such low levels. Build-up of the BRR infection to detectable levels in such cases may take one to two years.
- Low incidence may not be detected if inaccurate sampling occurs. This could lead to infected tubers bringing the bacteria onto a 'clean' seed farm, resulting in cross contamination during cutting operations.
- Trucks from commercial farms where BRR occurs could contaminate seed-farm storage and handling areas.
- Following an outbreak on a seed or commercial farm, inadequate sanitation and clean-up can result in persistence of the disease from one season to the next.
- Sugar beet roots colonized by BRR (but without disease symptoms) have been observed under field conditions and could, theoretically, be a source of BRR contamination in sugar beet production areas.

Best management practices for seed potato production

Good hygiene is a prerequisite for success, but it is also necessary for growers to be knowledgeable about the disease and to comply fully with the certification regulations. Complete success in eradicating this disease may only be accomplished by altering some of today's production practices in North America.

With current cultivation methods, the following points should reduce and ultimately eliminate the risk of BRR outbreaks.

- There is no substitute for good hygiene. Sanitation, cleanliness and disinfection are the keys to eradication of bacterial ring rot.
- All seed lots should be considered as potential sources of potato diseases, and precautions must be taken to break the disease contamination cycle between all seed lots handled, cut or planted.
- Equipment and storage areas must be cleaned and disinfected between seed lots.
- Cull piles and surplus stock must be disposed of well away from seed growing or storage areas. Culls that have not frozen should be buried. Plants growing from cull piles should be killed with herbicide as a safeguard against possible inoculum sources.

- Seed testing in some American states is less rigorous than in Canada. Seed growers must consider re-testing imported seed prior to planting. When a problem is found in a U.S. seed lot, the absence of a Canadian trace-back procedure means Canadian buyers will not be notified.
- Symptomless cultivars such as Desiree have the potential to carry BRR for several generations, despite a healthy appearance and lack of positive laboratory tests. They can infect more susceptible cultivars (Figure 4). Increased sampling and testing of these varieties is recommended before they are brought onto a seed farm to ensure freedom from BRR bacteria.



Figure 4. Norchip is highly susceptible to ring rot

- Whole or single-drop seed will prevent or greatly reduce the spread of BRR.
- Cross contamination during cutting can be eliminated by thorough disinfection of cutting equipment between lots.
- Open-cell foam rubber rollers can carry inoculum. Replacement with closed-cell rollers should be considered.
- Until more definite information is available, seed growers may be wise not to follow sugar beets with seed potatoes. As a precaution, steam clean or chemically disinfect all sugar beet equipment before bringing it into contact with potato storages and equipment.
- Access to seed storages and equipment by commercial growers and their trucks should be limited and controlled. Equipment should not be shared between commercial and seed farms.
- Trucks from commercial potato farms should be cleaned and disinfected prior to entering seed storages or seed handling areas.
- Detection of low levels of BRR on a commercial seed farm, as well as good record keeping and segregation of crops from different seed sources, can help in identifying the source of infected seed.

- If BRR is confirmed on a commercial farm, a thorough clean-up of storages and equipment must be carried out to reduce the chance of any bacteria remaining and causing contamination of incoming certified seed lots and, consequently, next year's potato crop.
- If BRR is missed because of inaccurate sampling, it will occur in next year's potato crop. BRR testing results of seed stocks are only as accurate as sampling procedures. Dollars spent on testing are wasted unless a representative sample is provided.

Alberta's seed potato industry has an excellent reputation as a leader in high quality, disease-free production (Figure 5). We all need to work together to keep it that way.



Figure 5: Northern vigour – seed potato production in Alberta

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