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Bacterial Ring Rot of Potatoes

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Bacterial ring rot of potatoes was described in Germany in 1906 but was not observed in North America until 1931 when the disease was found in Quebec, Canada. Since 1931 ring rot has been reported in all of the Canadian Provinces and has become generally distributed in the United States. Localized outbreaks of the disease have occurred from time to time in potato-growing areas in Oregon. In 1950 the disease caused serious losses in commercial fields in two of the main potato regions of the state, and several lots of certified seed were disqualified because of traces of ring rot.

Since ring rot is highly infectious and destructive in nature, all potato growers should become familiar with the disease and take precautionary measures to prevent its introduction into their seed stock. Once the disease is introduced into an area, it will build up rapidly unless control practices are rigidly carried out. The amount of ring rot in a seed lot may increase from a trace to as much as 50 to 60 per cent in a single season.

How to Recognize Ring Rot

The most characteristic field symptom of ring rot is a green wilt, which usually does not appear until late in the growing season (Figure 1). Leaflets wilt and droop while stems and petioles remain erect. All of the stems from a seed-piece may show typical wilting, or only one stem may become wilted while the others show no effect. When stems with wilted leaves are cut off near the ground line and squeezed, a creamy white mass of bacteria may be observed oozing from the conducting tissues.

Characteristic ring rot in tubers may be apparent at the time that wilting and death of the foliage occur or may not develop until after the tubers have been in storage for several months. Ring rot begins at the stem end of the potato tuber and follows the vascular ring where it may appear as dry, gray pockets or as a yellow or light brown strip of cheesy consistency (Figure 2). Decayed material may be forced out of the discolored ring if the tuber is squeezed in the hand. Recognition of the disease is frequently complicated by the presence of secondary fungi and bacteria which cause a more complete breakdown of the tuber. Development

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of secondary organisms may cause the outer surface of the tuber to crack and in advanced stages the outer shell may readily separate from tissues inside the vascular ring.

The most striking tuber symptoms are usually found in potatoes that have been held in storage for 3 to 4 months. In such infested tubers the entire vascular ring often becomes creamy yellow and of crumbly or cheesy texture. No odor is associated with such rot unless secondary rotting organisms are active.

Cause of the Disease

Ring rot of potatoes is caused by small, rod-shaped bacteria which enter the conducting tissues of potato plants. These bacteria live in the vascular ring or on the surface of infected tubers. When pieces of such infected tubers are planted, the bacteria move up into the conducting tissues of the stem and cause wilting and eventual death of the plants. As new tubers are formed, they are invaded by the bacteria. Such affected tubers may rot in the ground, may break down in storage, or may outwardly remain firm with only small pockets of rot in the ring near the stem end. Infected tubers that fail to break down in storage may serve as a source of spread from area to area and to healthy seed-pieces on the cutting table.

Ring-rot bacteria cannot survive long in the soil. Infection directly from contaminated soil apparently does not occur, and spread from infected plants to adjacent healthy plants has not been observed.

How Ring Rot Spreads

Infected tubers are the primary means by which ring rot spreads from one area to another. Ring-rot bacteria can survive and remain infective for a period of several months on sacks and equipment, however, and in this way the disease is frequently introduced into an area.

The greatest amount of spread from infected to healthy tubers occurs on the cutting table. A cutting knife that has been drawn through an infected tuber may infect the seed-pieces from as many as the next 20 to 30 healthy tubers. Transmission of ring-rot bacteria from infected to healthy seed-pieces may also occur in the handling of the seed-pieces and by rubbing of seed-pieces in the sack. In addition, picker planters and tuber unit planters can serve very effectively to spread ring-rot bacteria from infected to healthy seed-pieces.

Nature of the Losses Caused by Ring Rot

When potato seed lots become infected with ring rot, several losses may result:

- ▶ Loss in yield as a result of poor stand, death of infected plants, and rotting of tubers in the ground.

▶ Loss in storage. Potatoes from affected fields may rot in storage, resulting in loss in market value and in general contamination of other tubers and of storage facilities.

▶ Loss in transit. Affected tubers are often impossible to sort out. When such tubers break down in transit additional costs are incurred in resorting, repacking, and disinfecting equipment.

▶ Loss of certified seed. No tolerance of ring rot is permitted in certified seed potatoes. Therefore lots submitted for certification are disqualified by the presence of even a single ring-rot plant in the field or a single diseased tuber in storage or greenhouse samples.

Control of Ring Rot

Although ring rot is a highly infectious disease, it may be avoided or eliminated by following rigid control measures. As a general practice, it is well to use only certified seed potatoes as a means of keeping losses from all types of plant diseases at a minimum. This is by far the most practical control for ring rot. Those growers who do not use certified seed potatoes should carry out the following control practices if there is any record of ring rot in their area.

Precautionary Measures to Prevent Introduction and Spread in Seed Stock

- ▶ Carry out a thorough seed treatment program.

Prior to cutting, treat all planting stock in mercuric chloride (4 ounces in 30 gallons of water) for 1 to 2 hours to kill any ring-rot bacteria that may be on the surface of the tubers. This soak will also serve as a general clean-up treatment since it will effectively kill all other disease organisms on the surface of the tubers.

Immediately after cutting, dip cut seed-pieces in Semesan Bel (1 pound in $7\frac{1}{2}$ gallons of water) to kill ring-rot bacteria that may have been spread by the cutting knife. Care should be taken to plant seed-pieces that have been treated with Semesan Bel within 24 hours after treatment to prevent seed-piece breakdown resulting from chemical injury. (Phygon and Zerlate are not known to be effective against ring-rot bacteria.)

- ▶ Disinfect cutting knives. Preferably use a rotary cutting knife which rotates through a disinfectant. Mercuric chloride 1-500 (4 ounces in 15 gallons of water) is most commonly used.
- ▶ Do not use the same sacks for different lots of cut seed-pieces.
- ▶ Disinfect storage spaces.
- ▶ Avoid visiting infested fields and cellars and handling infected tubers.

► Use only new or disinfected sacks. It has been shown that ring-rot bacteria can live for several months on infested sacks. New sacks should be used when possible for handling cut seed since no completely satisfactory method of sterilizing infested sacks has been developed. It is hoped that current work at Oregon State College will lead to a more satisfactory method of sack sterilization. The most common methods now recommended for treating infested sacks are:

1. Exposure to steam (5 to 10 pounds pressure) for 20 to 30 minutes.
2. Soaking in formaldehyde solution (1 pint in 25 gallons of water) for 2 hours.
3. Exposing sacks to dry heat (140° to 160° F.) for 24 hours.

- Use common sense precautions.
- Do not borrow or loan equipment.
- Store seed potatoes apart from commercial stock.
- Use extreme caution in trying out new varieties of unknown history.

Precautionary Measures to Eliminate from Seed Stock and Storage Spaces

- Dispose of entire stock containing potatoes infected with ring rot. All unmarketable culls should be hauled away and destroyed or buried.
- Thoroughly clean and disinfect all potato storage spaces and storage and field equipment. Copper sulfate (1 pound in 10 gallons of water) or Lysol (1 pint in 25 gallons of water) is most commonly used for storage and equipment disinfection.
- Destroy or sterilize all sacks used in handling potatoes.
- Obtain certified seed for next planting. Do not bring new seed into storage houses where infected potatoes have been until storage houses and equipment have been thoroughly disinfected.



▲ FIGURE 1. Potato plant showing green wilt typical of appearance of disease in the field. Note erect stem at right with rolled, wilted leaves.

► FIGURE 2. Progressive stages in breakdown of ring-rot infected tubers. Upper right: yellow to light brown discoloration of vascular ring accompanied by soft, cheesy breakdown of affected area. Lower right: more advanced stages of vascular breakdown with affected area becoming brown and outer cortical tissues separating from that part of the tuber within the vascular ring.

