

## BACTERIAL WILT OF POTATO

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### PATHOGEN

*Ralstonia solanacearum*, previously called *Pseudomonas solanacearum*, is the causal agent of the disease known as potato brown rot or bacterial wilt (BW). The bacterium affects more than 30 plant species, the most susceptible crops being potato, tomato, eggplant, pepper and groundnut. Race 3 (Biovar 2A) strains, that affect mainly potato and occasionally tomato and other solanaceous crops and weeds, are the most common in higher elevations of the tropics (up to 3,400 m. a. s. l.). At lower elevations in the tropics, Race 1 strains are prevalent and affect a wide range of crops and weeds.

### SYMPTOMS

- **Foliage symptoms: Unilateral or total wilting of potato**

Above ground symptoms of BW include wilting (similar to lack of water), stunting and yellowing of the foliage. The browning of vascular bundles may be seen when the cortex is peeled. Characteristic too, is the initial wilting of only part of the stems of a plant, or even one side of a leaf or stem. If disease development is rapid, the entire plant wilts quickly, without yellowing. Alternatively, the diseased stem can wilt completely and dry up, while the remainder of the plant appears healthy (Figure 1).



Figure 1

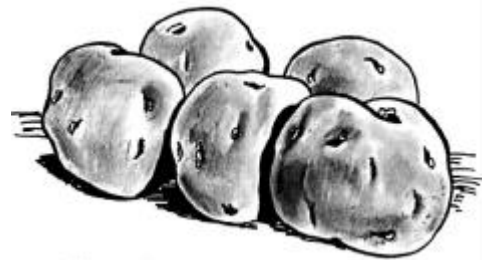


Figure 2

- **Tuber symptoms: Bacterial exudate in tuber eyes**

External symptoms on the tuber are visible at harvest when infection is severe. Bacterial ooze collects at tuber eyes causing soil to adhere to the secretions (Figure 2).

### FIELD DIAGNOSIS: The vascular flow test

Diagnosis in the field can be easily accomplished by cutting a piece of stem 2-3 cm long from the base, and suspending it in clear water in a glass container. The cut stem can be held with an opened paper clip to maintain a vertical position. Within a few minutes, the smoke-like milky threads exude from the cut stem (Figure 3).

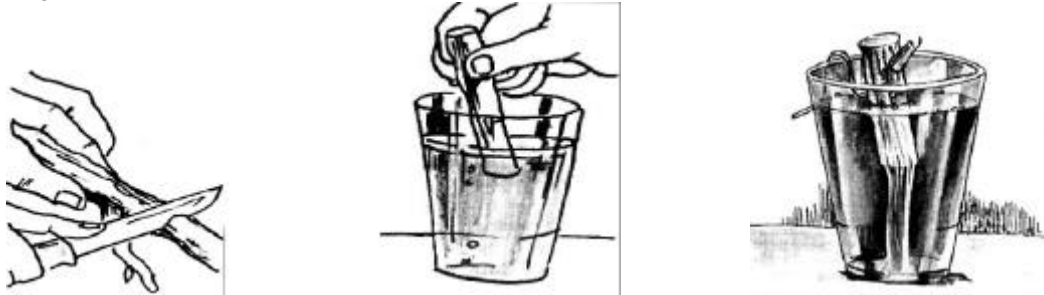


Figure 3

### **Bacterial exudate from vascular ring**

Tuber symptom is often described as brown rot. Cut tubers show a pus-like slime coming out of the vascular ring with a slight squeezing or it may exude naturally (Figure 4). In advanced stages of the infection, tubers exhibit brownish discoloration of the vascular ring,



Figure 4

### **DISSEMINATION**

Infected seed tubers are the main means of dissemination of *R. solanacearum* (particularly for race 3 strains). In cool conditions, such as tropical elevations above 2500 m, infected but symptomless plants may harbor the bacterium and transmit it to progeny tubers as latent infection, leading to severe disease outbreaks when grown at warmer locations. The pathogen can survive in soil (mostly on plant debris) and in the rooting system and rhizosphere of many hosts (weeds, other host crops, potato volunteers). *R. solanacearum* is mainly spread by movement of infected seed tubers. Contaminated surface water used for irrigation and infested soil adhered to farmers' feet and tools also contribute to disease dissemination.

Bacterial entrance into potato roots is facilitated by wounds made by tools during post-emergence cultivation, and by nematodes and insects in the soil.

## **CONTROL**

### ***Integrated management***

There is no effective chemical control, thus BW incidence can be reduced only if various control components are combined. An integrated disease management approach can lead to significant reduction, or even eradication of BW.

In a field where BW occurred rotate for at least 2 years with non-susceptible crops (non-solanaceous). Then only can be planted healthy seed, eventually of tolerant varieties if some have been identified in the area.

The application of various sanitation and cultivation practices are necessary. These include the removal of harvest leftovers, weeding, roguing of diseased plants and volunteer plants, minimum post-emergence cultivation, tools decontamination after having worked in an infested field. It is also preferable to plant during the cooler cropping season.

Since the root knot nematode (*Meloidogyne incognita*) facilitates the penetration of the bacteria in the roots that increases BW incidence, nematodes should be controlled by the means of soil fumigation or rotation with non-host crops.

### ***Use of healthy seed***

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For seed production, only BW-free seed tubers originating from disease-free areas must be used. The original planting material used in clonal (pre-basic and basic seed tubers) or positive selection multiplication scheme must be tested for latent infection with *R. solanacearum*. In endemic areas where healthy seed tubers are hardly available, an alternative to planting seed tubers is the use of true potato seeds (TPS) or clean cuttings obtained under controlled growing conditions from micropropagation.

### ***Detection of latent infection in seed tubers for the prevention and control of BW***

The classical method of detecting tuber infection consists of incubating tubers for 3 to 4 weeks at 30° C and observing oozing from the eyes or stolon ends, or cutting the tubers to observe oozing from the vascular ring. However, this method is time and space consuming and may not reveal low infection rates.

Because of this, CIP developed a simple, sensitive, quick and low-cost technique to detect latent infection in tubers that is suitable for seed testing: post-enrichment NCM-ELISA (Enzyme linked immunosorbent assay on nitrocellulose membrane). The kit is being distributed to seed programs worldwide. This method can also be used for varietal evaluation for resistance to BW, for the development of control components and for studies on disease epidemiology (survival, spread of the pathogen).

**RECOMMENDATIONS FOR THE CONTROL OF BACTERIAL WILT OF POTATO  
CAUSED BY *RALSTONIA SOLANACEARUM***

<b>General control strategy</b>	<b>Recommendations</b>
<p><b><i>I.- Exclusion / avoidance</i></b> Exclude / avoid pathogen from the field (prevent dispersal before pathogen reaches the field).</p>	<ul style="list-style-type: none"> <li>• In non-infested soil plant only disease-free seed tubers, seedlings obtained from true potato seed (TPS) or clean cuttings</li> <li>• No cutting of seed tubers</li> </ul>
<p><b>II.- Control</b></p> <p><b><i>2.1. Cultural and sanitation practices</i></b> Eradicate or weaken pathogen (prevent survival of pathogen and its dissemination once it is in the field).</p> <p><b><i>2.2. Plant resistance</i></b> Prevent or suppress susceptibility to infection (provide plant needs, foster plant resistance/tolerance to pathogen)</p>	<ul style="list-style-type: none"> <li>• Remove and destroy crop remains after harvest (removed haulms and leftover tubers must be burned or buried deep-down slope)</li> <li>• Crop rotation with non-solanaceous crops</li> <li>• Weeding</li> <li>• Roguing and destruction of wilted plants as soon as they are observed</li> <li>• Roguing of volunteer plants soon after their emergence</li> <li>• Irrigation with uncontaminated water</li> <li>• Minimum post-emergence cultivation</li> <li>• Tools decontamination (washing with water or bleach or sterilized by flame) and washing of feet</li> <li>• Bare fallow (with weeding, no irrigation)</li> <li>• Exposure of plowed soil to summer heat and sun</li> <li>• Maintain plant vigor by providing adequate nutrition (organic and inorganic) and moisture</li> <li>• Use resistant or tolerant varieties</li> <li>• Minimum post-emergence cultivation to minimize injury to plant</li> <li>• Control nematodes and insects in soil</li> </ul>