# Bontera Research

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As of July 29, 2021

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# Contents

# 1 Potatoes

## 1.1 Soft Rot

### 1.1.1 Description

Bacterial soft rot affects a number of fruits and vegetables, including potatoes. It is a post-harvest disease, occuring while the crop is stored or in transit (Rich, 2013). It is characterized by a watery soft spot on the side of the crop and an strong odor.

### 1.1.2 Geography and Soil Type

Soft rot arises worldwide, from South Africa (Ngadze et al., 2012) to the northeastern United States (Ge et al., 2021). Pérombelon notes that the soil has to be both nutritionaly deficient and over-watered for soft rot to spread. Some bacterium are specific to potato soft rot because of the cool, temperate climate where they are grown (Pérombelon, 2002). Soft rot favors warm temperatures and high moisture levels in the soil and during storage (Rich, 2013).

### 1.1.3 Cause

Two main genera cause soft rot: *Pectobacterium* and *Dickeya* (Youdkes et al., 2020). Bacterial growth is accelerated by any wound or puncture of the potato skin, especially a tender spot formed by standing water or insect bites breaking the outer layer (Rich, 2013).

### 1.1.4 Biosolution

Historically, farmers have used water-management and sanitation to control soft rot, but the bacterial predator *Bdellovibrio bacteriovorus* and similar organisms have shown considerable promise as well, according to a recent study by Youdkes et al. (2020). All the strains tested were effective in reducing *Pectobacterium* and *Dickeya* greatly. Strains introduced in the tubers before the onset of soft rot were much more effective in fighting it later on, possibly because glucose consumption by the prey was not inhibiting growth (Youdkes et al., 2020).

A second study found that certain varieties of rhizosphere bacteria could also be used to control soft rot caused by *Pectobacterium* strains (Krzyzanowska et al., 2012). The results indicate that 18 various rhizobacteria were effective in inhibiting the spread of soft rot, out of the 1165 tested. The study noted, however, that the bacteria's ability to control *Pectobacterium in vitro* may not reflect the true results *in vivo*.

## 1.2 Golden Nematode Disease

### 1.2.1 Description

Nematodes are nearly invisible worms that attack potato plants and tubers (Rich, 2013). Rich also reports that some nematodes cause disease directly, while others act as vectors or catalysts for viral and fungal illnesses. Plants affected by golden nematode disease have necrotic and wilting leaves with stunted growth; many do not recover, resulting in severely reduced crop yeilds (Rich, 2013).

### 1.2.2 Geography and Soil Type

The golden nematode is native to Peru, but has spread all throughout the world (Rich, 2013). They can survive in any climate that potatoes can grow, but very strict quarantine and sanitation guidelines have prevented further spread (Evans & Brodie, 1980).

Mimee et al. (2015) found that optimal nematode egg hatching occurs when soil temperatures are between $59°F$ and $80°F$. The determined that increasing temperatures in cooler climates could lead to accelerated spread of golden nematode disease. Both dry weather and light soil favor the disease (Rich, 2013).

### 1.2.3 Cause

The golden nematode (*Globodera rostochiensis*) is the main cause of Golden Nematode Disease (Rich, 2013). The disease gets its name from the golden or brown cysts containing nematode eggs present after an infestation (Rich, 2013). This is how the the disease spreads: the cysts cling to containers, equipment, and tubers and are transferred between fields or farms.

### 1.2.4 Biosolution

Some farmers have reported the natural decline of nematode populations because of fungi parasitism (Evans, 1993). 10 species were isolated from the soil, *Cylindrocarpon destructans* being the most promising (Evans, 1993). That same study found that "when an inoculum of straw colonised by *C. destructans* was placed around potato seed tubers planted in [nematode] infested soil ... the numbers of juvenile stages of *G. rostochiensis* ... decreased by 62%."

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