Potato Progress

Research & Extension for the Potato Industry of Idaho, Oregon, & Washington

Andrew Jensen, Editor. ajensen@potatoes.com; 509-760-4859

www.nwpotatoresearch.com

Volume XV, Number 12 | *8 September 2015*

Late Season Management of Bacterial Diseases

Phillip Wharton, Mike Thornton, Nora Olsen, University of Idaho;
Jeff Miller, Miller Research; Jonathan Whitworth, USDA-ARS;
Alan Westra, Idaho Crop Improvement Association

Introduction

The soft rot pathogens of potato (*Pectobacterium* spp. and *Dickeya* spp.) are generally thought to be disseminated on seed but may also be soil, mechanically disseminated, and/or water-borne. *Pectobacterium* spp. (formerly known as *Erwinia* spp.) are important bacterial potato pathogens in Idaho and can be aggressive on tubers and stems causing wilting (blackleg and aerial stem rot) and eventual plant death (Fig. 1). *Dickeya* species (formerly *Pectobacterium chrysanthemi*) have emerged as a new threat to potato production in Europe. *Dickeya* spp. were first reported on potato in the Netherlands in the 1970s. However, since 2004 a new pathogen with the proposed name *Dickeya solani*, has been spreading across Europe on seed tubers. Toth *et al.* (2011) described the symptoms as "indistinguishable from those of the more established blackleg pathogen *Pectobacterium* spp." However, *Dickeya* spp. are different from *Pectobacterium* spp. epidemiologically in that they can start disease in potatoes from lower inoculum levels, spread more readily through the plant's vascular tissue, are more aggressive, and have higher optimal temperatures for disease development. *Dickeya* spp. also appear to be less able to survive than *Pectobacterium* spp. in soil and other environments. Until recently, reports of *Dickeya* spp. causing disease on potato in the U.S. have been rare. It has previously been reported in Washington State in 2008, but never in Idaho. This year (2015) there have been reports of an outbreak of *Dickeya dianthicola* across the country from Maine to Michigan that has been spread via seed potatoes. The pathogen was found in potato fields with poor emergence and a high incidence of blackleg and rotten daughter tubers. In Europe, *D. dianthicola* strains are more variable than the more recently reported *D. solani*. The origin of the U.S. *Dickeya* outbreak and variability among strains is unknown. Recently, *Dickeya* was discovered causing aerial stem rot symptoms on potatoes in Idaho. The samples (likely *Dickeya dianthicola*) are currently undergoing further diagnostics to determine the species and strain. As far as we are aware this is the first time *Dickeya* has been reported in Idaho.

Management of bacterial diseases

The bacterial pathogens that cause soft rot of tubers, and wilting and necrosis of stems and foliage may be introduced as secondary-infecting pathogens after the plant has been compromised. For example, bacterial soft rots of tubers can be introduced after fungal infection or through wounds caused by mechanical damage (Fig. 1). The management options for control of these two species (*Pectobacterium* and *Dickeya*) are limited, but are the same regardless of the species. Early season management relies on good seed health practices such as planting certified seed and using a good seed

treatment to prevent seed piece decay. Research at the UI has shown that copper sprays applied weekly starting at row closure can provide some protection against aerial stem rot in very susceptible potato varieties. Late in the season, practices that reduce exposure to damage during harvest, storage and post-storage are important in the control of soft rots. These were reviewed by Knowles and Plissey (2007) and included a checklist of pre-harvest factors such as washing digging equipment, timing of crop desiccation (dependent on canopy and tuber maturity), storage preparation including inspection, repair and cleaning of insulation, ducts, fans and humidifiers, doors, sensors and control panels. Modifications to harvest equipment are important factors in managing soft rot bacteria and other pathogens that enter through damaged tuber periderm, such as late blight, pink rot and *Pythium*. Knowles and Plissey (2007) identified the harvester as being the major source of mechanical damage to tubers and made recommendations that could reduce damage. These included adjustments to the digging blade, reducing drop heights, and use of padding on hard surfaces to decrease bruising. The potential for damage continues from harvest to loading of tubers onto bulk trucks and to the storage-bin piler, and similar recommendations based on the use of improved padding and flow speeds were made. Preferably, crops should be harvested when tuber pulp temperature is in the range 45 - 65°F, to eliminate temperature gradients which can promote the development of condensation that in turn enhance the conditions that are conducive for the development of soft rot. Some other important factors that reduce the risk of soft rot developing during the early storage period include:

- Limiting the pile size to a height of 16 – 18 ft
- Quickly cooling the tubers to the final storage temperature (37, 41, 45 and 50°F for seed, table-stock, French fry and chip processing, respectively)
- Fans run to dry the tubers as much as possible
- Do not harvest low spots or other areas that have elevated levels of tuber decay
- Sort out rot during storage filling, aiming to keep infection levels below 3%.
- Pile high-risk lots in areas of the storage that can be removed quickly if rot begins to develop
- Daily monitoring for high-risk areas with elevated temperature and/or moisture

Diagnostic testing

Until relatively recently, detection and identification of the soft rot bacteria *Pectobacterium* and *Dickeya* species depended solely on the isolation of viable bacterial cells on semi-selective media followed by serological and biochemical analyses, bioassays and microscopic observations. However, in the past couple of years there has been a big push to develop molecular methods for the detection and discrimination between the different species of *Pectobacterium* and *Dickeya*. There are now multiple PCR-based tests available for the detection and identification of soft rot bacteria down to the species level, but few have been extensively tested and validated in the U.S. At the University of Idaho Potato Pathology lab in Aberdeen we have the latest real-time PCR primers to detect and distinguish between *Pectobacterium* and *Dickeya* species and also species-specific primers to differentiate between *D. dianthicola* and *D. solani*. We also have a LAMP assay for *Pectobacterium* which allows us to detect the pathogen within 40 minutes of sample submission. As these primers for *Dickeya* were developed in Europe, they still need to be validated for use against any *Dickeya* isolates found in Idaho. If you are having a problem with soft rot please send samples to UI Aberdeen, your nearest University research center or Miller Research for diagnosis.

Figure 1. The disease cycle of soft rot bacteria.

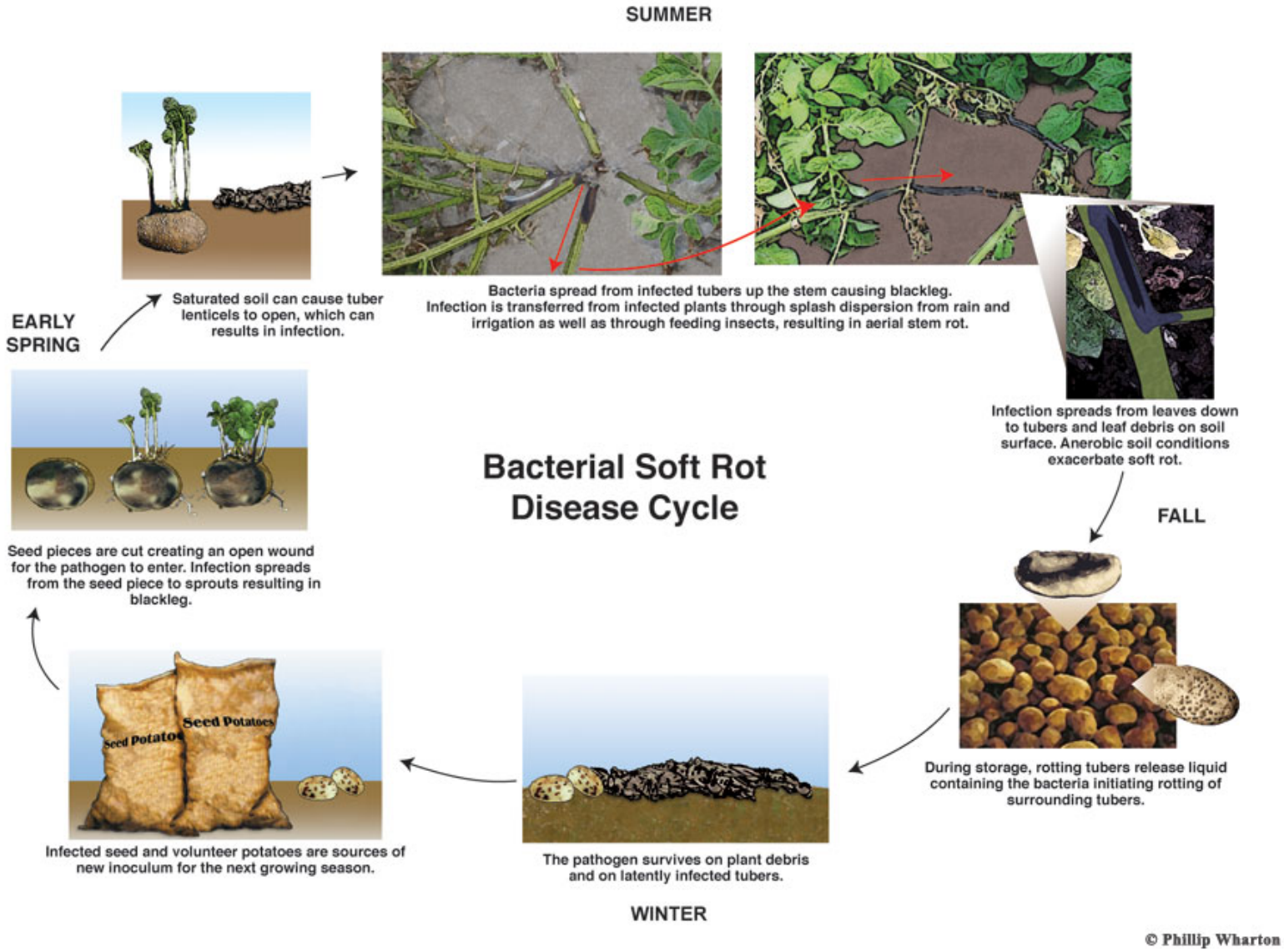
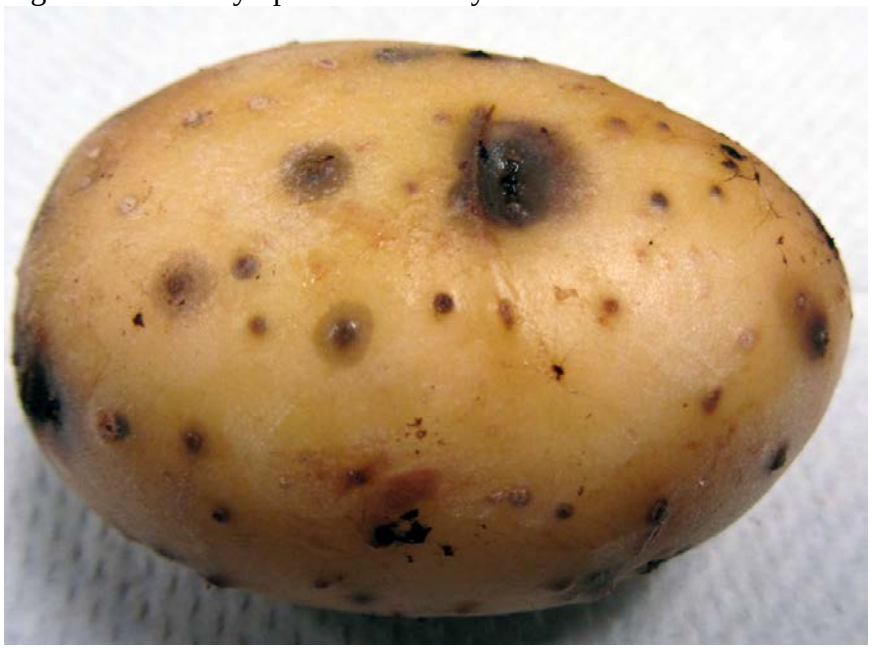


Figure 2. Foliar disease symptoms caused by bacterial diseases.

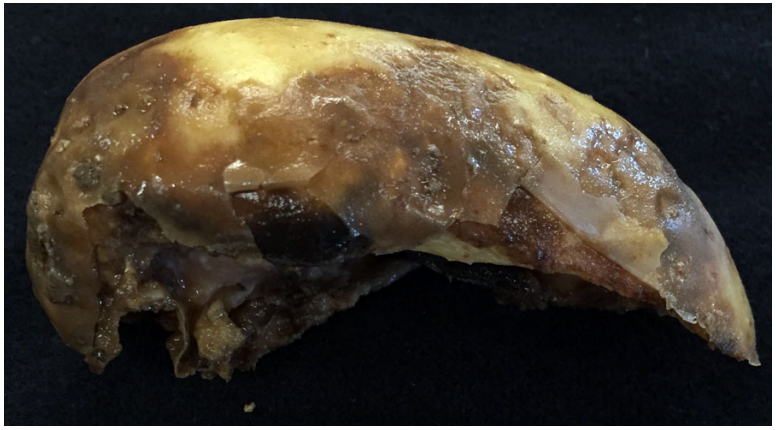
Blackleg symptoms showing wilted foliage and blackened stems. Stems become blackened from the ground up. It is virtually impossible to distinguish blackleg symptoms caused by *Pectobacterium* species and *Dickeya* species. The main differences are that *Dickeya* species are more likely to cause blackleg late in the season while *Pectobacterium* causes blackleg early in the season.

Figure 3. Tuber symptoms caused by bacteria soft rots.

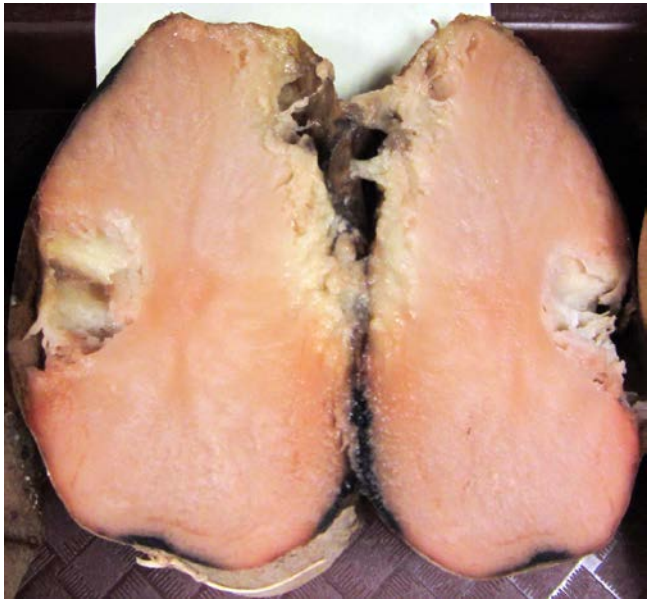


Pit or lenticel rot caused by *Pectobacterium* spp. usually caused when washed tubers are stored under wet conditions.

Pure soft rot infection of a tuber.



Soft rot often follows other pathogens such as *Phytophthora infestans* (late blight).



Soft rot following infection by *Phytophthora erythroseptica* (pink rot).

Northwest Potato Research Consortium

A Cooperative Effort of the Potato Commissions of ID, OR, & WA

Andy Jensen, Manager (ajensen@potatoes.com; 509-760-4859)

Research Review Plans for Fall 2015 – Winter 2016
For more details, see: www.nwpotatoresearch.com

In February 2012 the state potato commissions in Washington, Idaho, and Oregon officially launched a new cooperative effort in research. One aim of this initiative is to increase cooperation and efficiency of the research/extension programs funded by the three potato commissions that total almost $2 million annually. A second aim is to facilitate competitive federal grants for potato research in the Northwest. Potato production across the region is substantially similar and faces similar research gaps. For the *third* time, a majority of this research funding will be allocated through a cooperative 3-commission research review process during the fall-winter of *2015-16*. A nine-member Consortium board (3 members from each state) will review research proposals and make funding recommendations to the commissions.

Scope

The Consortium funds research in all aspects of potato production, breeding/variety development/genetics, and storage, and is open to considering research in food product development, processing, etc. All persons contemplating suggesting a new project should consult the list of funded projects posted on the website, www.nwpotatoresearch.com to avoid proposing something that conflicts with or duplicates existing research. We welcome scientists new to the region or to our funding to engage with us. A good first step is to contact Consortium Manager Dr. Andy Jensen about how your expertise and interests might best fit the research needs of the potato industry. Other valuable sources of guidance and input on research ideas are the established potato research and extension scientists across the region.

Time-line for fall/winter of 2015-16

Fall research planning discussions.
Dates: October 29-30
Location: Portland, OR, Sheraton hotel near the airport

Format: Industry members from each state will be present. Scientists will be scheduled to present concept proposals and answer questions from the group. Projects on similar topics will be grouped on the agenda to the extent possible. Each concept proposal discussion will be 10-15 minutes.

Schedule: One and a half days of concept proposals followed by an afternoon of industry discussion.

Purpose and intent: The aim is to have discussion among all present, i.e. scientists and industry members, about each concept proposal. Following the discussions, industry members present and the Consortium board will arrive at decisions regarding projects, teams, and ideas that will be expanded into full proposals for Consortium consideration in January.