2011 Specialty Crop Block Grant Final Report

Project Title: Determining Incidence of Three Diseases in Utah Stone Fruit Orchards

Marion Murray, Utah State University, and Partner: Utah State Horticultural Association

Project Summary

We initiated this project due to an increase in tip dieback symptoms in peach orchards in Utah starting in 2009. Speculation as to the cause led some growers to apply fungicides that may have been unnecessarily applied, or may have been applied at the wrong timing. To understand the problem, the first ever formal survey of stone fruit diseases was conducted in Utah.

This project surveyed Utah stone fruit orchards for three specific diseases: brown rot (*Monilinia fructicola*), bacterial canker (*Pseudomonas syringae*), and cytospora canker (several *Cytospora* sp.). Brown rot has never been found in Utah, but is a problem on peaches in some parts of the West including California and parts of Colorado, resulting in yield losses due to diseased flowers and fruit and tip dieback. *Pseudomonas* is a bacterial disease that is often found on sweet cherry but rarely on peach. Cytospora is a common pathogen of peach. Both *Pseudomonas* and cytospora cause stem cankers and require proper pruning, plant health maintenance, and prevention of wounds, rather than chemicals to manage.

On the ten farms surveyed, coryneum blight was the most common pathogen found (although we were not directly surveying for it). Coryneum does cause tip dieback. Cytospora was the next most common pathogen, followed by *Pseudomonas*. *Monilinia* (brown rot) was not found on any samples collected in this survey, and we concluded that the tip dieback growers were seeing was caused by winter freeze injury, coryneum blight, or cytospora. Results of this project will help to build the capacity of Utah Plant Pest Diagnostic Laboratory in diagnosing plant diseases accurately and provide control recommendations, and will enable growers to more profitably implement stone fruit disease IPM programs.

Project Approach

The lead investigator (Marion Murray, USU) received training from Colorado State University in spring 2010 in identification techniques for stone fruit pathogens, including preparation of specialized media, fungal identification, and incubation techniques. Marion then trained a student assistant in 2011 to help work on the project. Marion and the student assistant both collected plant material and isolated fungi. Marion did the diagnoses and the GPS plotting and GIS mapping.

Orchard blocks sampled in this survey

Orchard Name	Location	Size (Acres)	Crop	Predominant Pest
Box Elder Orchard 1	Perry	4	peach	cytospora canker
Box Elder Orchard 2	Perry	6	sweet cherry	bacterial caner
Box Elder Orchard 3	Perry	15	peach	cytospora canker
Box Elder Orchard 4	Perry	12	peach	cytospora canker
Box Elder Orchard 5	Perry	3	sweet cherry	bacterial caner

Orchard Name	Location	Size (Acres)	Crop	Predominant Pest
Utah County Orchard 1	Payson	30	peach	cytospora canker
Utah County Orchard 2	Genola	15	sweet cherry	bacterial caner
Utah County Orchard 3	Santaquin	32	peach	cytospora canker
Utah County Orchard 4	Santaquin	12	peach	cytospora canker
Utah County Orchard 5	West Mountain	35	sweet cherry	bacterial caner

In 2011 we surveyed 10 stone fruit orchard blocks on 3 different dates in May, June, and August. At each survey date, we checked 10 trees by walking a random zigzag pattern and examining every tenth tree. We observed trees for symptoms (oozing twigs, dieback, blighted flowers, rotted fruit). Where they occurred, we collected tissue from that tree. During the May sampling date, we also collected healthy-looking flowers because the pathogen, *Monilinia,* causes latent infections in flowers, and symptoms do not show up on fruit until harvest. We plotted each symptomatic tree using a Trimble GPS.

Examples of symptomatic tissue collected

bacterial canker (*Pseudomonas*)

cytospora canker

secondary root rot introduced by insect

bacterial canker damage to fruit

The symptomatic plant tissue that was brought back to the lab was then identified to cause. We cultured fungi or bacteria from the samples using incubation to induce sporulation (cytospora), plating plant tissue onto potato-dextrose nutrient agar (cytospora, *Monilinia*, coryneum blight), or crushing plant tissue in water and streaking a droplet across specialized nutrient media for growing bacteria (*Pseudomonas*). When necessary, we wet-mounted spores for identification and examined them under a microscope.

Of the 100 asymptomatic flowers that were collected and cultured, none were positive for *Monilinia*. Most did not grow anything on the agar, and a few grew saprophytic fungi (non-pathogenic) that would be found anywhere in nature.

We collected a total of 248 plant samples with symptoms. Most samples were dead or dying twigs with visible gumming, while the rest consisted of leaves and fruit. Cytospora was identified most often, on 63 samples, and bacterial canker was identified on 34 samples. Although we were not looking for coryneum blight (shothole), this disease was found on 92 trees (based on visual observation). The remaining 151 samples were all diagnosed as caused by abiotic factors (primarily temperature extremes) or mechanical injury. Most of those cultures did not grow any fungi, while the remaining grew saprophytic (non-disease-causing) fungi, such as *Pennicillum*, *Alternaria*, or *Cladosporium*.

In spring 2010, we trained county agriculture Extension agents to identify brown rot, cytospora, and bacterial canker. In 2011, we received four brown rot suspected fruit samples (*Monilinia*): one from Box Elder County, one from Salt Lake County, and two from Utah County. All were negative for *Monilinia*, and were determined to be a secondary rot introduced by stink bug or other insect feeding, and from split pits.

Although the disease, brown rot, was not found, we did see that the disease, bacterial canker, is more widespread than originally thought. The main reason for this is due to the cool, rainy springs northern Utah has experienced for the last 3 years. Incidence of this disease would certainly increase if we had not identified its widespread presence and notified growers. Through outreach efforts, growers can initiate management of this disease, as recommended by USU, to prevent further spread.

This report has been posted onto the IPM website at: utahpests.usu.edu/ipm/htm/publications/research, along with the bulleting showing brown rot symptoms that was distributed to growers at field meetings and to Extension agents. Marion included a short article on brown rot in the Tree Fruit IPM Advisory in spring 2011, and will include a more in-depth report of this project in a spring 2012 edition. The advisories are emailed to a subscription of 3600 fruit growers in Utah. Marion will present results of the survey to growers at the 2012 Utah State Horticultural Association, attended by approximately 80 growers.

Goals and Outcomes Achieved

1. The Utah Plant Pest Diagnostic Lab, located on the USU campus, is now aware of the diseases that commonly occur on Utah stone fruit trees. Cultures collected from this survey were donated

to the Utah Plant Pest Diagnostic lab, where they may be used to help the lab improve response time to clients submitting stone fruit disease samples.

2. Results of this project will be used by Marion Murray and the USU Extension plant pathologist to develop integrated pest management strategies for stone fruit diseases through the production of fact sheets and information output in the weekly Tree Fruit IPM Advisories. Marion will also incorporate results of this project into the 2012 Utah-Colorado Tree Fruit Management Guide.

3. Knowing which diseases are established in stone fruit orchards will allow Extension agents and specialists the ability to provide early warnings of potential disease outbreaks so that appropriate control measures may be accurately advised.

4. A long term outcome is that we expect to see improvements in profitability for Utah stone fruit growers due to improved ability to properly identify these disease symptoms. There have already been improvements in 2011, where growers that had been applying fungicides (at least 3 treatments) for brown rot in spring of 2009 and 2010, safely stopped those applications, saving upwards of $34/acre for one treatment. Pesticide applications should only be made when exact confirmation of a particular disease is made. It is important that growers are aware that diseases managed with cultural controls, such as cytospora and bacterial canker, should be pruned out to prevent spread and losses.

5. Maps showing prevalence of cytospora and bacterial canker will be used by Extension faculty and county agriculture agents at Utah State University as well as by the Utah State Horticultural Association. Growers and others will know where the disease was occurring in 2011 and could use the information for prevention of spread, for establishing new orchards, and for removing old orchards. The maps also show soil types, which can affect tree health, which in turn affects tree susceptibility to disease. For example, peach trees growing on the Pleasant Vale gravelly loam soil (see map, Utah County Orchard 4) that do not receive enough irrigation, will be stressed, and more susceptible to cytospora canker.

6. This project provided a training opportunity for a USU student employee majoring in biology. The student (3^{rd} year level) learned about disease identification, monitoring and sampling techniques, sterile culturing and incubation techniques, photography, and management strategies. The experience he gained working on this project will help him in his senior level classes, as well as in finding a job in his area of interest, which is sustainable landscaping.

Beneficiaries

All commercial operations growing stone fruits in Utah will benefit from this project. Approximately 200 operations grow stone fruits in Utah on 5,181 acres. Utah is second nationally in tart cherry production, comprising 47% of all Utah grown tree fruits, and 61% of Utah stone fruits (3,150 acres). Peach is the second most commonly planted stone fruit, comprising 1,278 acres (26% of the total stone fruit acreage). Residential backyard growers will also benefit as this group contributes significantly to

pesticide applications, and having a greater understanding of fruit tree pests (through the weekly Tree Fruit IPM Advisories and Master Gardener outreach activities) will help them to fine-tune applications.

Lessons Learned

1. Weather patterns affect plants and pathogens, and frost causes dieback in stone fruit more often than previously thought. Weather the past three springs was cold and moist, ideal conditions for spread of cytospora, bacterial canker, and coryneum blight, but not for brown rot. Weather conditions change from year to year so we will continue our search for unusual symptoms and other pathogens in our daily research and monitoring activities in Utah orchards.

2. Due to Utah's overall drier climate, symptoms may appear differently than what is recorded in the literature, or may affect only certain plant parts. It is important to collect plant specimens for culturing fungi that may not represent the typical symptoms for that target pathogen.

Contact Person

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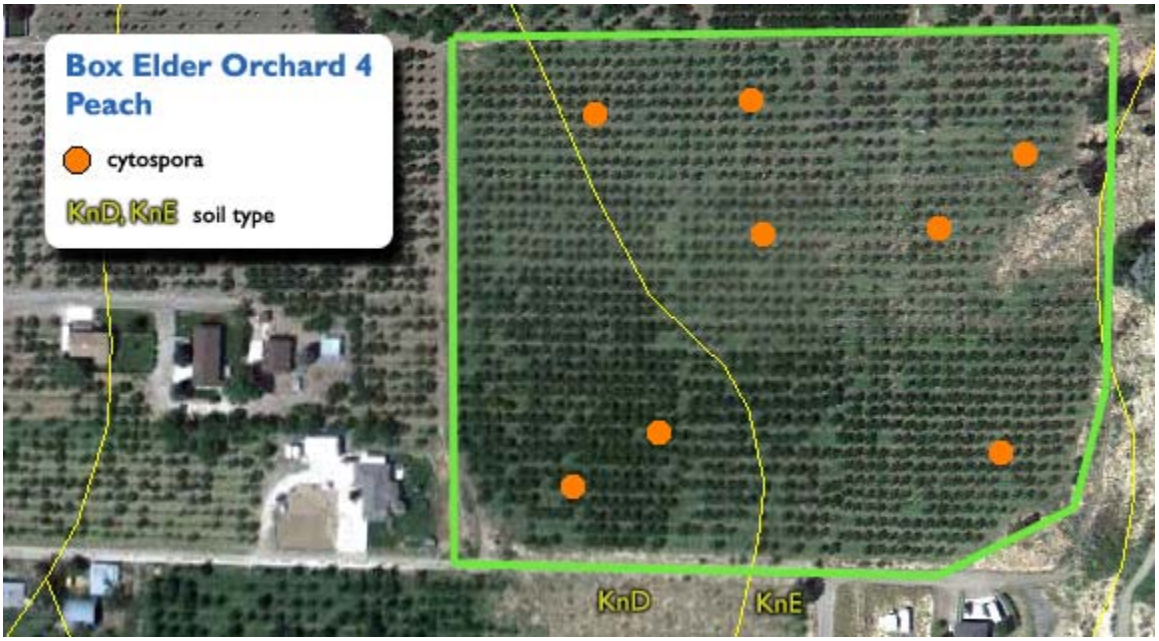
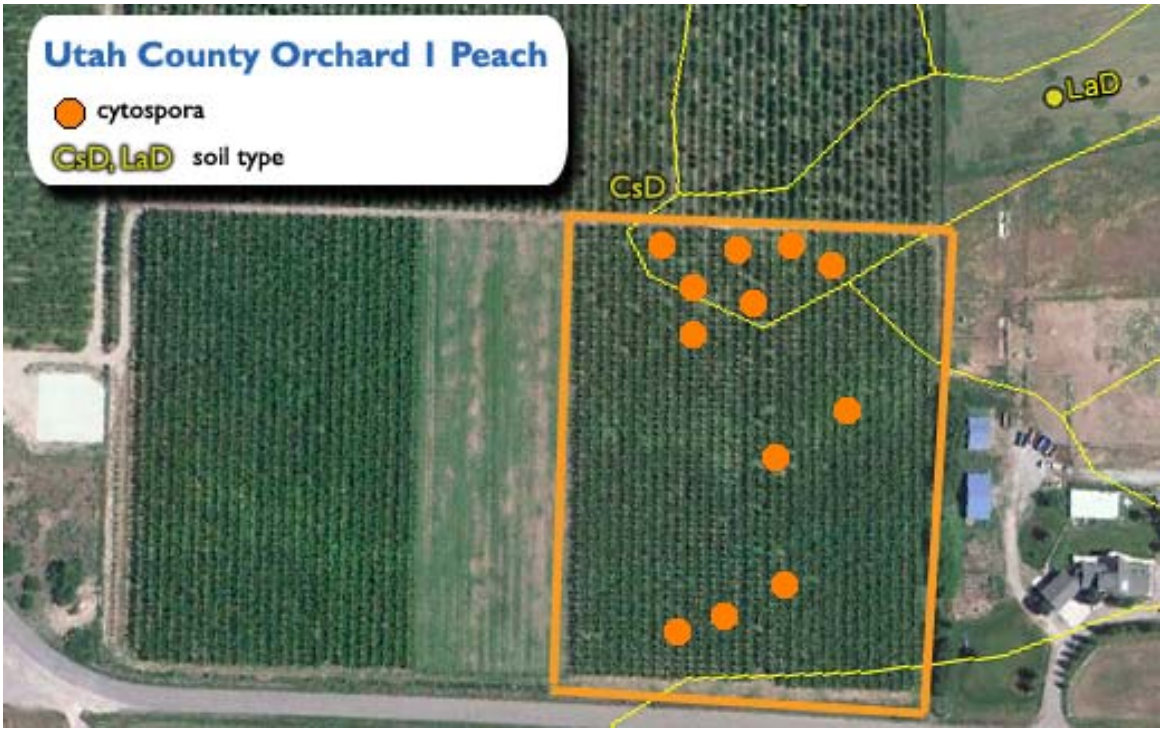
Additional Information

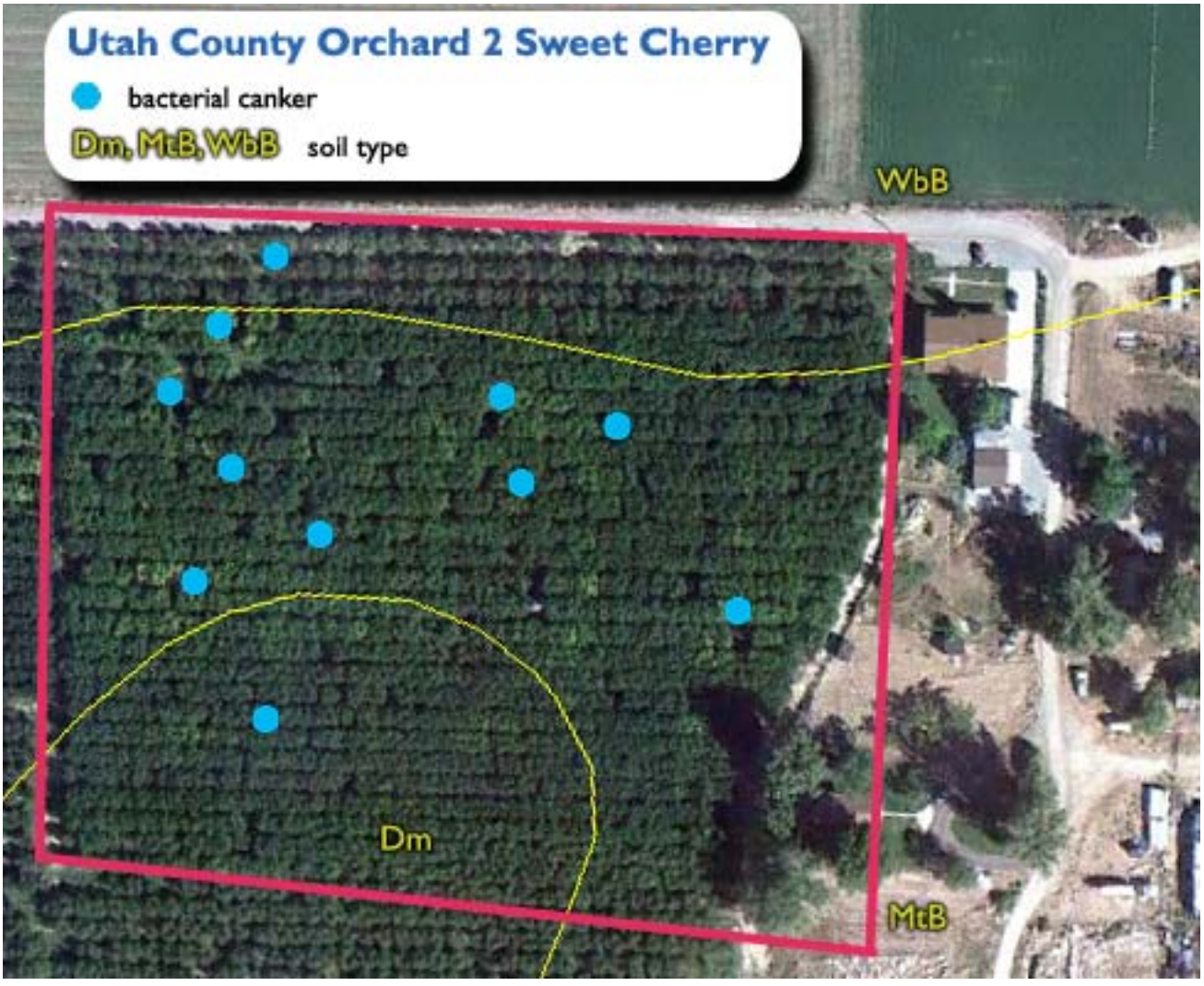
GIS orchard maps of individual orchards shown below. They are also available on Google Maps, sent to users with a login (Extension specialists and agents)

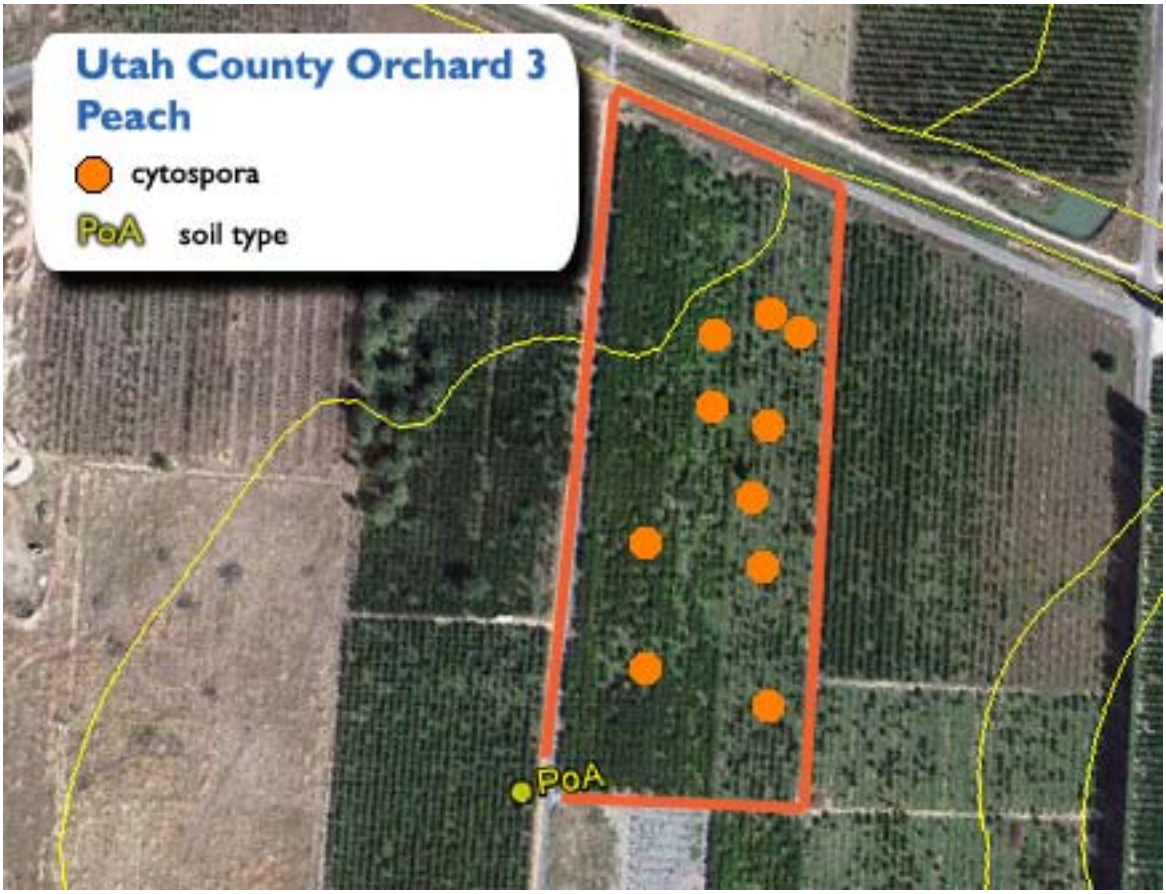

Box Elder Orchard 3
Peach
cytospora
KnC... soil type
KnC...
KnC

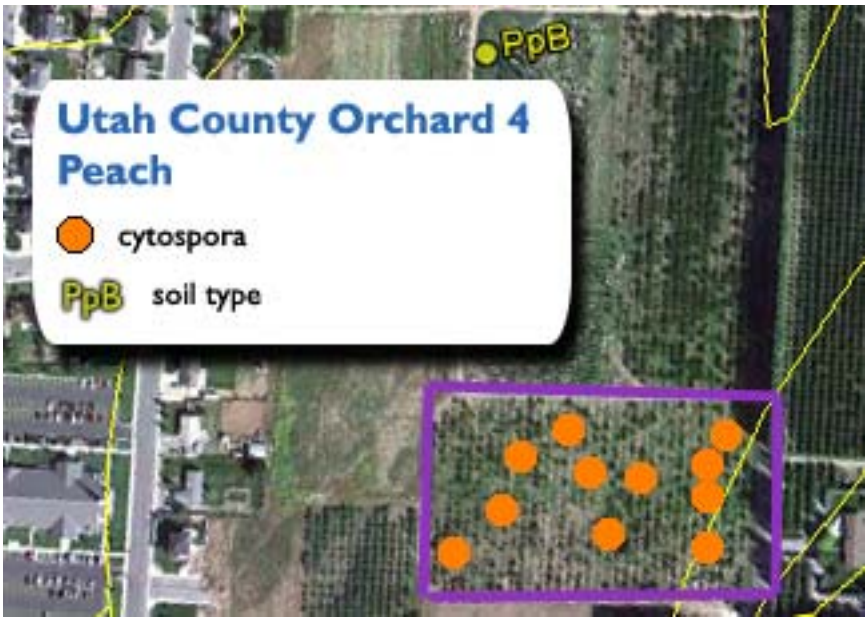

Box Elder Orchard 4
Peach
cytospora
KnD, KnE soil type
KnD
KnE

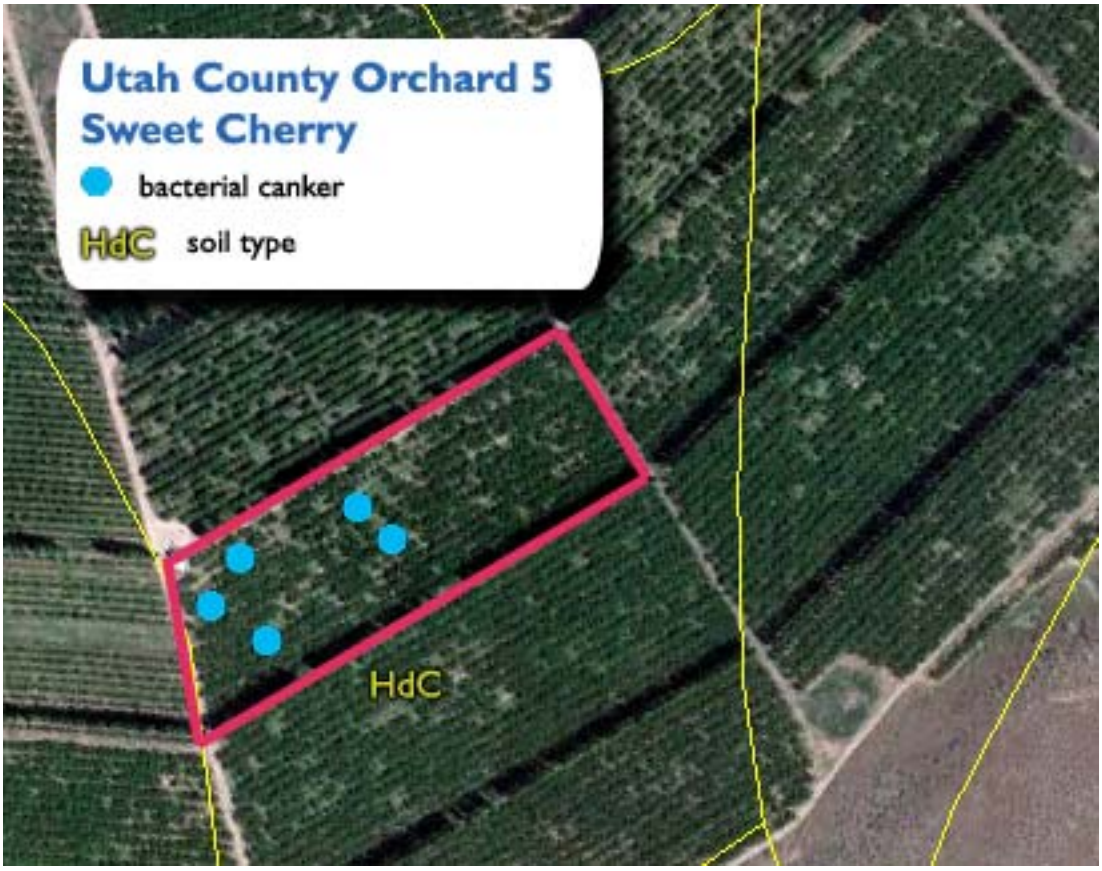

Box Elder Orchard 5 Sweet Cherry
bacterial canker
KnD soil type
KnD


Utah County Orchard 1 Peach
cytospora
CsD, LaD soil type
CsD
LaD

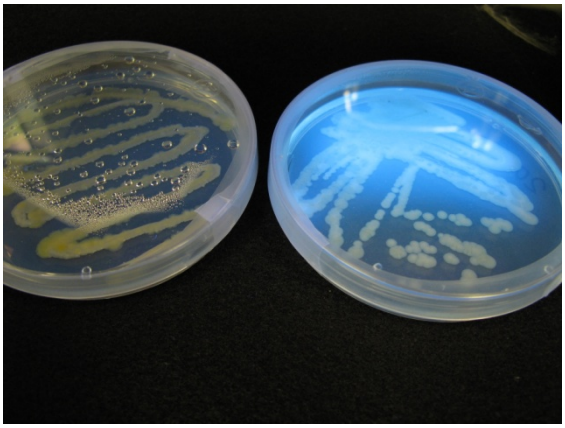

Utah County Orchard 2 Sweet Cherry
bacterial canker
Dm, MtB, WbB soil type
WbB
Dm
MtB


Utah County Orchard 3
Peach
cytospora
PoA soil type
PoA


PpB
Utah County Orchard 4
Peach
cytospora
PpB soil type



Images of Cultures:



Pseudomonas syringae culture fluorescing

Cytospora culture

Handout describing symptoms:

IF YOU SEE SYMPTOMS LIKE THESE, PLEASE CONTACT

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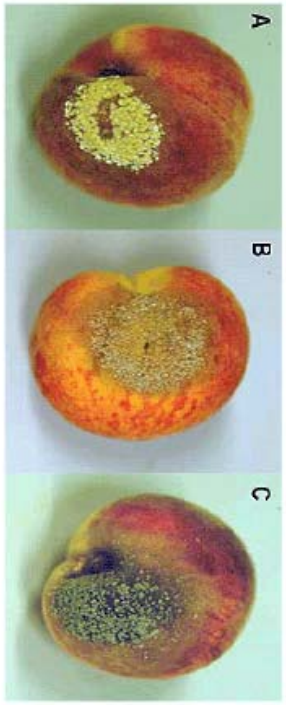

Brown rot is a fungal disease of cherry and peach, caused by either *Monilinia laxa* or *M. fructicola*. Although the fungus may be present in Utah, we rarely see the disease because our usually hot and dry climate conditions are not conducive to growth of the fungus nor formation of disease. Three springs in a row of cool, moist weather, which favors this disease, may result in the appearance of this pest in some orchards.

Brown rot causes browning and wilting of flower blossoms followed by death of the small twigs. The leaves will remain attached on twigs killed by brown rot. Gumming may be associated with the dying flowers.

The primary damage (on previous page) shows up later on fruit nearing harvest time as large, brown, rotted areas with gray, ball-shaped, powdery tufts.