Providing Northwest berry growers with the information they need when they need it.

The Small Fruit Update is sent out weekly during the growing season by Peerbolt Crop Management and is funded entirely by the Northwest berry growers and industry through their commissions and councils.

Research Update – Blueberry Disease
Pseudomonas syringae (Bacterial Blight)

January 3, 2013

This document is a guide and not intended as a recommendation or endorsement. Consult with your supplier, field representative, or pest consultant for more specific, regional advice and/or recommendations.

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New Version of the Small Fruit Update Newsletter
--In depth, single topic--

This 'Research Update' format is new for the Small Fruit Update. I've been mulling over for a while how to best communicate research findings that could directly affect a grower's bottom line. The recent work done on bacterial blight presented an ideal test case.

Tom Peerbolt, SFU Editor

The Weather Cafe by Rufus La Lone Small Fruit Cold Storage Report

Pseudomonas syringae symptoms in blueberries

These photos are from Joyce Loper's & Virginia Stockwell's power point presentation of their recent work on this disease. Details of their findings are reported below

Overview

- A lot of copper is being applied to PNW blueberry fields for control of *Pseudomonas syringae* (Bacterial Canker).
- There is strong evidence that copper is not an effective control for most strains of the disease present in PNW blueberry fields.
- Unlike some plants, there are many strains of this disease that cause damage in blueberries which makes management increasingly difficult.

- There are no other proven alternatives to copper for managing the disease.
- Pruning out and removing infected plant material can be effective, but is economic only under very specific situations, such as a small field or a particularly vulnerable cultivar.
- Blueberry cultivars have varying degrees of susceptibility to *P. syringae*, and new data have given us better protocols for determining this.
- There's now a better understanding of the timing of when blueberries are vulnerable to *P. syringae* infection which can lead to better timed application of management materials.
- A lot of money and resources are being used in an ineffective way to minimize damage from this disease. We need a better understanding of how to best use what tools we have and to invest in finding better management alternatives.

Disseminating information for:

Washington
Washington Red Raspberry Commission
Washington Blueberry Commission
Washington Strawberry Commission

Oregon
Oregon Raspberry and Blackberry Commission
Oregon Blueberry Commission
Oregon Strawberry Commission

British Columbia
Fraser Valley Strawberry Growers Association
Raspberry Industry Development Council
B.C. Blueberry Council

National
North American Blueberry Council

The Basics

Reason for Concern

- Economic damage is caused in two ways:
  1) The various strains of the bacteria itself have varying degrees of toxicity.
  2) This is an 'ice-nucleating' bacterium. Water in infected cells freezes at a higher temperature than the water in uninfected cells so that infected cells will be damaged at temperatures above normal freezing conditions.
- Young plants are particularly susceptible to major damage due to more vigorous, soft growth and a reliance on thin, young canes that can be girdled and killed by the disease's lesions.

Identification/Symptoms

- Tissue infected in the fall or early winter can show no symptoms until the late winter/early spring when water-soaked lesions appear on 1-year-old canes/branches in January or February.
- These lesions develop into reddish-brown to black, irregularly shaped cankers with defined margins.
- Cankers can extend from a fraction of an inch to the entire length of the stem and sometimes girdle stems.
- In the late winter/early spring, as temperatures warm and the buds swell, plants become more vulnerable to new infections.
- Once buds or other tissue are infected, they are much more likely to be damaged by any cold temperature events that occur after bud swell.

Disease Cycle

- The bacterium survives and multiplies on the surface of buds, bark and stem, but is incapable of causing damage until it permeates the tissue.
- Entry is through wounds, pruning cuts and/or natural openings, such as leaf scars, and probably through frost or winter-injured tissues as well.
- *P. syringae* bacteria are almost universally present and spread easily by wind, rain and many other means.

Management factors /comments

- There is a *strong correlation between damage symptoms and cold temperature events in spring*. While tissue can be infected, if the temperatures remain above the level where ice would form in that tissue, there can be little or no actual damage from the infection.
- Avoid over-fertilization and late-season fertilization, especially on new plantings, as this creates an overabundance of highly susceptible growth.
- Newly swelling buds are highly vulnerable to infection.

Timing of management material applications

- There is no research evidence *(that I know of…TP*) that suggest fall applications are effective in blueberries. Original recommendations for fall applications in blueberries were based on work done in other crops like cherries. Subsequent research trials in blueberries have not shown any measurable effect.
- In conversations with researchers, fieldmen & growers, there seems to be a consensus that applications during dry weather windows in February are ideal. This is when buds are close to or beginning to swell. Subsequent rains can spread the bacteria to this tissue and subsequent cold can increase the damage to any tissue that does get infected.
- Application timing goals are to *prevent* infections by *protecting* vulnerable tissue *throughout the window of time* when temperatures can drop into the range that ice can form in any infected tissue.

Treatment material options

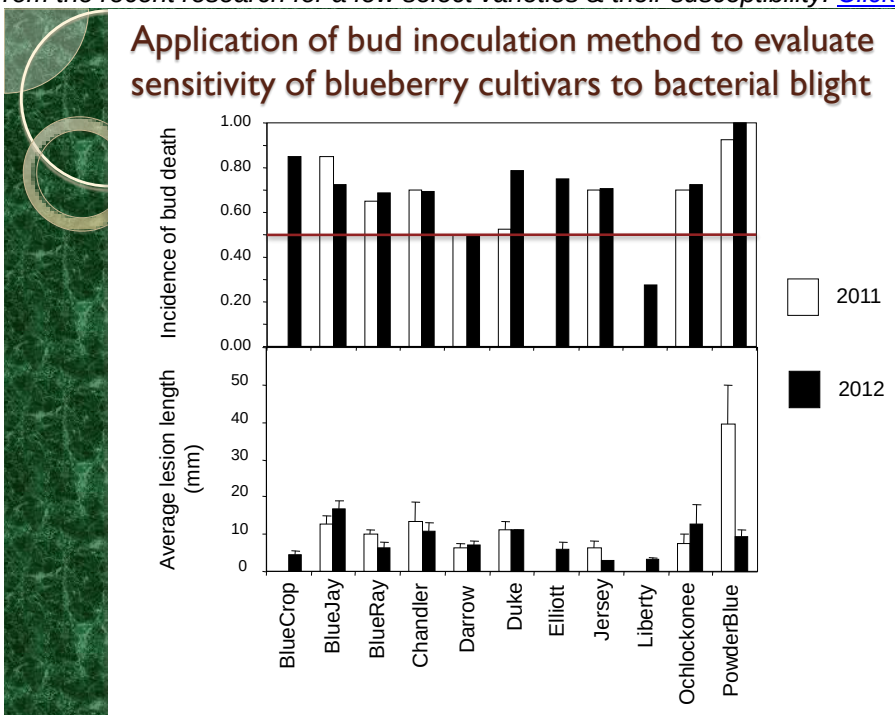
- **Copper products** Click here for a list of available copper products and recommendations on their use. While copper is the standard material used, quite a few other materials have been used/evaluated. None of the other options have yet shown reliable disease suppression. Grower reports of their usefulness are inconsistent at best. There is a need for more work to determine whether any of them (or other options) could be of economic benefit in an overall Pseudomonas management program.
- **A couple of the other materials used**
  - **Serenade Max** *(Bacillus subtilis)* Click here for label. Click here for a two minute video showing how Serenade works to suppress plant diseases. In some trials Serenade Max has shown some efficacy against bacterial blight. In other trials it hasn't. My opinion is that, given the right timing and conditions, it could be useful. The problem is knowing when and what those conditions are.
  - **BlightBan A506** *(Pseudomonas fluorescens)* Click here for label. *P. fluorescens*, competes with *P. syringae* to colonize plant tissues and suppress the damaging bacteria. In theory, it could reduce frost damage caused by this disease. Trial results are very mixed. Copper can't be used with this product because it kills the active ingredient.

Cultivar Susceptibility/Resistance

One of the goals of this recent research project was to develop a reliable plant assay test to be able to better determine cultivar susceptibility to this disease. They've done that. We might be able to breed disease resistance into future cultivars or at least be able to objectively evaluate them for how susceptible they are.

- Click here for an Oregon State chart of blueberry varieties & their susceptibility ratings based on previous work.

Below is a chart from the recent research for a few select varieties & their susceptibility. Click Here for full size pdf.



Recent Research

This research was presented at the Northwest Center for Small Fruits Research Conference in Kennewick, WA on November 29, 2012.

Title

Population Dynamics of *Pseudomonas syringae* and management of bacterial blight of blueberry

Click here for a pdf of the power point presentation on this research.

Researchers

Joyce Loper, USDA-ARS, Horticultural Crops Research Lab
Virginia Stockwell, Dept of Botany & Plant Pathology, OSU

Funding & Plant materials

NW Center for Small Fruits Research
Fall Creek Nursery
Oregon Blueberry Growers
Howard Hughes Medical Institute
(Undergraduate Summer Research Program)
USDA-ARS HCRL
Oregon State University

Research Objectives

1) Develop knowledge of the disease cycle for bacterial blight of blueberry
2) Develop reliable disease assay
3) Characterize pathogenic isolates of *P. syringae* isolated from blueberry

Objective 1 Summary: Develop knowledge of the disease cycle for bacterial blight

- Pathogen populations increased in/on buds and emerging tissues in late fall through spring. *P. syringae* populations were low on leaves and new buds in mid-summer through early fall.
- *P. syringae* was common on tissues not showing symptoms from a research plot, where diseased tissues were not removed.
- *P. syringae* was not detected on tissues not showing symptoms from a grower's field, where diseased tissues were removed frequently.

Objective 2 Summary: Develop reliable disease assay

- Cut leaf and bud inoculation methods evaluated.
- Most consistent method was inoculation of buds during early spring with freeze-dried cells of the pathogen.

Objective 3 Summary: Characterize pathogenic isolates of *P. syringae* isolated from blueberry

- We monitored growth of *P. syringae* on blueberry over two years.
- In plots, where diseased tissues were not removed, the disease causing bacteria multiplied to high populations from November through June.

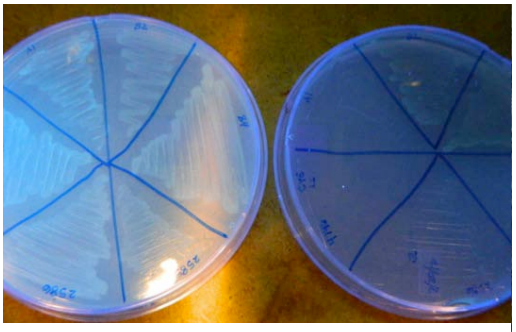
- In a grower's field, where diseased tissues were removed, the disease causing bacteria was rarely isolated.
- We developed a useful method to inoculate blueberry plants with *P. syringae* and applied the method to evaluate cultivar sensitivity to bacterial blight.
- From molecular and phenotype tests, we determined that isolates of *P. syringae* from diseased blueberry do not form a distinct phylogenetic cluster. We conclude that many pathovars of *P. syringae* cause bacterial blight of blueberry. *(Interpretation: There are many different strains of these bacteria that can cause damage in blueberries. This means that there are many other possible hosts for this disease in the vicinity of a field and makes management much more complicated.)*
- Copper resistance is common among *P. syringae* isolates from blueberry.

Copper Resistance

The following slide indicates that 12 of 18 pseudomonas strains that were collected from blueberries grew in the presence of a high concentration of copper indicating that they would not be controlled by copper applications in the field.

Copper resistance

Growth on media containing 0.32 mM copper = copper tolerant strain



Copper concentration (mM)

Host	Strain	0	0.16	0.32	0.8	1.2
Honeysuckle	2585	+	+	-	-	-
Lilac	2571	+	+	-	-	-
Blueberry	5 Nursery	5	5	2	0	0
	13 Growers	13	13	10	7	2
Cu sensitive	Cit 7	+	-	-	-	-
Cu tolerant	AL513	+	+	+	+	-

Key
+ = growth
-= no growth

Majority of isolates of *P. syringae* from commercial blueberry fields are resistant to copper.

Take Home Messages

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