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# Whatcom *Ag* Monthly

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# WSU'S WADDL IS SITE FOR LATEST AVIAN INFLUENZA TESTING

Charlie Powell

Public Information Officer, WSU College of Veterinary Medicine

Animal disease authorities both nationally and in Washington were already on high alert when in early December a large wild duck die-off occurred in Northwest Washington.

The event was soon under investigation by the Washington Department of Fish and Wildlife. The alertness and quick response was all part of the multi-agency disease surveillance vigilance that comes with knowing British Columbia, Canada, had begun dealing with an outbreak of HPAI, strain H5N2, earlier this fall.

On Dec. 9, samples from the ducks were tested for avian influenza (AI) at the Washington State University, Washington Animal Disease Diagnostic Laboratory in Puyallup, Wash. (WADDL-Puyallup). Results were presumptive positive for a highly pathogenic avian influenza virus.

The "highly pathogenic" designation means it was an influenza virus capable of causing severe disease and high mortality in domestic poultry.

On Dec. 11, a privately-owned falcon from the same region was submitted by its owner to WADDL-Puyallup for cause of death determination. Based upon the history of being legally fed wild duck meat, testing for AI was once again initiated immediately. Within hours results were presumptive positive for two indicators of HPAI. By protocol, additional samples from both cases were expedited to the USDA-National Veterinary Services Laboratory (NVSL) in Ames, Iowa, for confirmatory testing and further virus characterization.

Independently, samples were also received by the USGS National Wildlife Health Center in Madison, Wisc. On Dec. 14, the falcon was confirmed

## KEY INFORMATION:

- On Dec.15, the United States Department of Agriculture announced the presence of two strains of highly pathogenic avian influenza (HPAI) in wild birds in Washington State.
- To date, both strains of HPAI are occurring **ONLY** in wild bird species in Washington State.
- There is **NO SIGN** of the viruses in any commercial poultry flocks.
- There is **ALMOST NO RISK** to human health as the disease has never been seen in people in the U.S.
- The many strains of AI occur commonly in wild birds worldwide and the disease risks are well-known to both human and animal disease experts.



**Figure 1.** The comb and wattles are congested and markedly edematous.

Photo: Dr. D. Swayne, USDA



**Figure 2.** The shanks are swollen (edema) and extensively reddened (hemorrhages). Photo: Dr. D. Swayne USDA.

positive for the H5N8 strain of AI, or HPAI H5N8.

Almost simultaneously with the identification of HPAI in the falcon, a wild duck from the same geographical region of Washington was also confirmed positive for HPAI H5N2.

Immediately after the confirmation of HPAI in Washington State, the USDA, Washington State Department of Agriculture, the Washington Department of Fish and Wildlife, the Washington Department of Health, and WSU's Washington Animal Disease Diagnostic Laboratory collaborated with others to establish a pre-planned incident command structure and an aggressive enhanced surveillance program for AI.

On Dec. 18, WSU-WADDL in Pullman, began receiving samples for HPAI testing in its Biosafety Level 3 (BSL3) testing laboratories, a core laboratory in the National Animal Health Laboratory Network. WSU-WADDL's experienced and highly trained laboratory staff use state-of-the-art equipment to conduct high throughput testing, meaning large volumes of samples and the shortest turn-around times. Combined with its information technology expertise and nationally standardized procedures WSU-WADDL can effectively and safely conduct HPAI testing.

It is expected that surveillance testing will continue for months and include analysis of perhaps thousands of samples. Should the situation worsen, WADDL and its partner laboratories in the National Animal Health Laboratory Network are prepared to handle whatever testing loads may arise. WADDL is also working closely with both NVSL and the NWHC in further diagnostic testing and characterization.

### **Important information links:**

#### **USDA**

All bird owners, whether commercial producers or backyard enthusiasts, are encouraged to practice good biosecurity, prevent contact between their birds and wild birds, and to report sick birds or unusual bird deaths to State/Federal officials, either through your state veterinarian or through USDA's toll-free number at 1-866-536-7593. Additional information on biosecurity for backyard flocks can be found at:

<http://healthybirds.aphis.usda.gov/>

#### **Washington State Department of Agriculture**

Persons seeing sickness in domestic birds are asked to contact the WSDA Avian Health Program at 1-800-606-3056. Sick and dead wild birds should be reported to the Washington Department of Fish and Wildlife at 1-800-606-8768. If you are concerned about sickness in you or your family, please contact Washington State Department of Health at 1-800-525-0127.

<http://agr.wa.gov/> and <http://agr.wa.gov/News/2014/14-25.aspx>

Washington State Department of Fish and Wildlife

Kristin Mansfield, WDFW Veterinarian (509) 892-1001, ext. 326 or cell (509) 998-2023

[http://wdfw.wa.gov/conservation/health/avian\\_flu/index.html](http://wdfw.wa.gov/conservation/health/avian_flu/index.html)

# BOTRYTIS DISEASES OF RASPBERRIES AND BLUEBERRIES

Dalphy O.C. Hartevelde and Tobin L. Peever  
Department of Plant Pathology, Washington State University

**B**otrytis diseases cause large annual losses (up to 30%) to the raspberry and blueberry industries in the Pacific Northwest (PNW). Levels of disease are highly variable from year to year and control is costly and inconsistent. The disease affects many different hosts, different tissues of each host, and control is dependent upon frequent, calendar-based applications of fungicides. The pathogen is notorious worldwide for its ability to develop resistance to fungicides making Botrytis diseases a persistent threat to berry production in the PNW.

## Significance

The causal agent of Botrytis diseases, *Botrytis cinerea*, has a wide host range and causes economically significant losses to more than 200 crops worldwide 16 including protein, oil, fibre and horticultural crops in both temperate and subtropical regions. Small fruit crops and vegetables are the most severely affected by this pathogen 16. In small fruit crops, the disease is referred to as "gray mold". Gray mold or Botrytis bunch rot of wine grapes is the most studied Botrytis disease among the small fruit crops. Other small fruit crops that are affected by *B. cinerea* include blueberries, blackberries, raspberries and strawberries. In highbush blueberry (*Vaccinium corymbosum*) the pathogen is known to cause three diseases: tip blight, blossom blight and fruit rot. In red raspberry (*Rubus idaeus*) the pathogen causes three diseases: blossom blight, fruit rot and cane Botrytis. In this article, we will focus on the biology and management of Botrytis diseases of berries.

## Disease symptoms

### Tip blight of blueberry

Infected twigs become brown to black and turn tan or grey at a later stage. The twig blight progresses from the tip toward the base. Black sclerotia (overwintering structure of the fungus) can be found near the tip of the blighted twigs 10.

### Blossom blight of blueberry

Blossoms appear as brown and water-soaked (Fig. 1). The blossoms are often covered in dense, gray, powdery growth of the pathogen 10.



**Figure 1.** Botrytis blossom blight symptoms on blueberry. Photo Jay Pscheidt, OSU

### Fruit rot of blueberry

There are two types of fruit rot, green berry fruit rot starts as a brown discoloration near the calyx end of the fruit 10. The brown area expands until the entire berry rots and shrivels. The berry either drops from the cluster or adheres to the plant and often displays the gray, powdery growth of the pathogen (Fig. 2 and 3). Ripe berry fruit rot



**Figure 2 and 3.** Botrytis fruit rot symptoms on blueberry. Photos Dalphy Harteveld and Olga Kozhar, WSU

occurs post-harvest, where rot symptoms appear and the fungus shows growth on the surface of the fruits.

### Raspberry cane Botrytis

The fungus infects mature, senescent leaves causing a wedge-shaped brown lesion with yellow margin that spreads to the nodes of primocanes 16. Lesions appear as tan to brown, often incorporating more than one node. The lesions show concentric ring patterns (Fig. 4). These infections



**Figure 4.** Raspberry cane Botrytis symptom. Photo Dalphy Harteveld, WSU

can affect the development of lateral shoots the following season.

### Blossom blight of raspberry

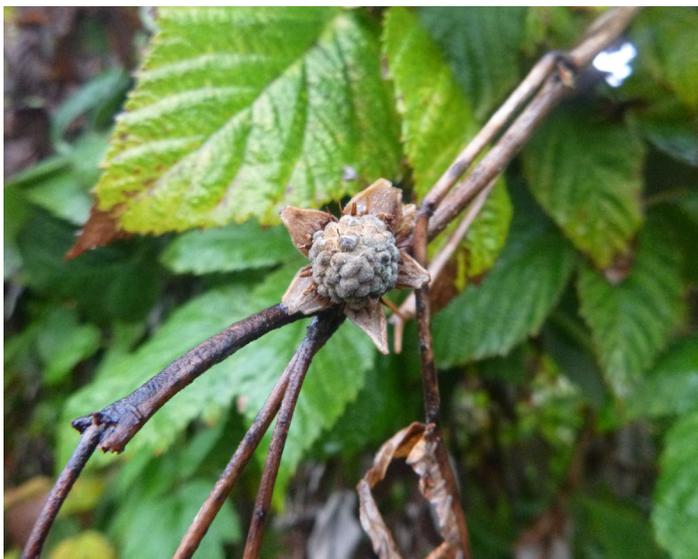
Infected flowers turn brown and shrivel. Green, gray, powdery mass of fungal growth is visible on the surface of the flowers at a later stage.

### Fruit rot of raspberry

Fruit rotting appears as soft spots on the fruit, which enlarge over time. The fruit shows dense, gray, powdery growth of the pathogen (Fig. 5 and 6).

### Identity of the pathogen

The Botrytis pathogen of raspberries and blueberries is commonly known as *Botrytis cinerea*. However, recent studies have demonstrated that *B. cinerea* infecting grapes is actually a complex of species that look the same and are called "cryptic" species 6. Genetic markers are required to differentiate them. Similarly, multiple cryptic Botrytis species may infect raspberry and strawberry 1 and a recent study of blueberries in California has similarly demonstrated infection by two species: *B. pseudocinerea* and *B. cinerea* 12 that are similar in appearance. These species may respond differently to fungicides which makes identification important for disease control. It is currently not known if *B. cinerea* populations

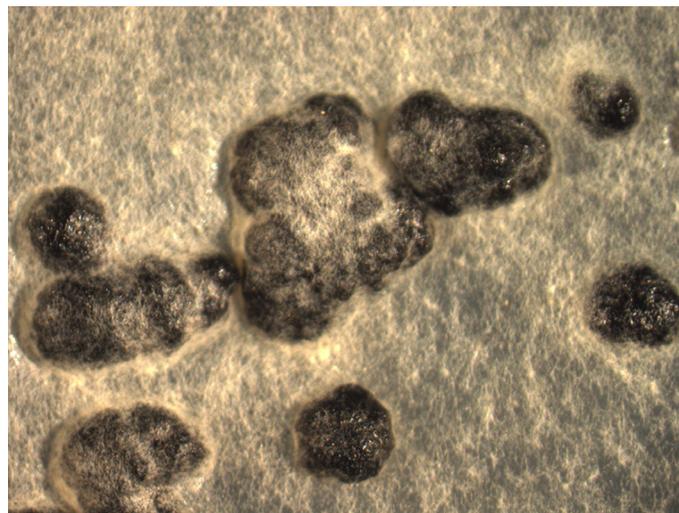


**Figure 5 and 6.** Botrytis fruit rot symptoms on raspberry. Photos Dalphy Harteveld, WSU

infesting raspberry and blueberry in the PNW are different or if they might be specialized on particular plant parts (e.g. raspberry fruit versus canes).

### The disease cycle

The disease cycle of *B. cinerea* has been studied for many years, particularly on grapes, yet many questions remain. The great flexibility of the pathogen to adapt to different environments and the possible involvement of multiple cryptic species demonstrate that disease cycles may be specific to each region and host. Particular dis-



**Figure 7.** Botrytis sclerotia (black compact mass) and mycelium (white) on agar medium. Photo Dalphy Harteveld, WSU

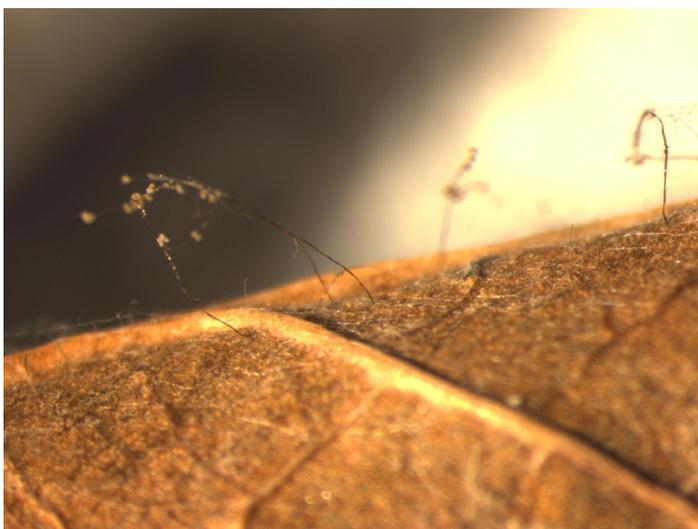
ease control strategies may be effective in some areas and not in others. More specific, in depth studies of the disease cycle of *B. cinerea* in berries is urgently needed in the PNW.

### Overwintering and sources of inoculum

In raspberry, the fungus overwinters as black, oblong sclerotia (black compact mass of hardened fungal mycelium) in infected canes and as mycelium in infected leaves in the plant canopy and leaves and canes on the ground. Under conducive environmental conditions, fungal mycelium develops from the sclerotia (Fig. 7). This mycelium produces specialized structures for producing spores (conidia) called conidiophores. These conidiophores develop further to produce conidia (Fig. 8 and 9). The main sources of primary inoculum for Botrytis diseases are conidia produced from overwintering sclerotia, dead leaves, and mummified berries<sup>3</sup>. In blueberries, the fungus overwinters as dormant mycelium and sclerotia in plant debris, including dead twigs and pruned branches<sup>4, 10</sup>.

### Dispersal

In early spring, the fungal mycelium becomes active and produces large numbers of conidia on the surface of leaf debris. Conidia are spread by wind and rain throughout the field where they are



**Figure 8 and 9.** Botrytis sporulation structures (conidiophores) and spores (conidia) produced on a blueberry leaf. Photos Dalphy Harteveld, WSU

deposited on blossoms and fruit 3. Fluctuations in temperature and humidity control the production and dissemination of the conidia 7.

### Infection

Germination of conidia that land on plant surfaces occurs within a few hours when free water is present and when temperatures are between 70 and 80 degrees F (20 to 27 degrees C)<sup>3</sup>. This water can come in the form of rain, dew, or fog, or from water from irrigation (Fig. 10). Temperature and periods of moisture are the main factors controlling infection of blueberry and raspberry 10, 11. Infection can occur at lower temperatures if

the tissue remains wet for longer periods. Under appropriate conditions, the germinated spores (Fig. 11) produce a germ tube which then penetrates and invades the host tissue. Infected cells collapse and disintegrate and the tissue rots. On the surface of the infected tissue the pathogen produces new conidiophores and conidia which are then dispersed to new plants and the cycle of infection is repeated. Infection can also occur through wounds in plant tissue created by equipment, mechanical harvesting or by insects such as the raspberry beetle *Byturus tomentosus* 17.

Flowers of raspberry are highly susceptible to *B. cinerea* infection. Flower buds are generally not infected, but open flowers are rapidly colonized and leads to subsequent fruit infection 2. Flower infection occurs when conidia are dispersed to stigmas which provide a nutrient source for the germinating conidia 9. In raspberry and other small fruit, infections appear to occur during bloom, but symptoms only appear as the fruit ripens 9. These types of infections are referred to as "latent" or "quiescent" because the fungus colonizes floral parts but remains latent and emerges as the fruit starts to mature 3. Despite the available evidence that *B. cinerea* infects raspberry floral parts and these infections lead to fruit rot, many questions about the infection process remained unanswered. A better understanding of this infection process is key to improved control of Botrytis fruit rot. Studies using highbush blueberry cultivars Duke and Brigitta showed that the most susceptible infection stages for flowers are late pink bud and full bloom and over-mature fruit showed to be the most susceptible fruit stage 11.

### Disease control

Fungicide applications have been the main disease control strategy in berry crops. However, an increasing number of reports from around the world have demonstrated that *B. cinerea* has developed resistance to most of the fungicides that are currently used. In Germany, Botrytis isolates affecting small fruit have demonstrated resistance to multiple fungicides 13, and these resistant



**Figure 10.** A moist environment induces Botrytis infections.  
Photo Dalphy Hartevelde, WSU

populations pose a major threat to small fruit production. Alternative measures to control these diseases are urgently needed.

Cultivar selection also plays a major role in the control of plant diseases. Although no raspberry or blueberry cultivars with high levels of resistance have been reported, some cultivars may develop less disease than others. The raspberry cultivars "Meeker", "Munger", "Chilliwack", "Comox", "Fairview" and "Meeker" appear less susceptible than other cultivars that are grown in the Pacific Northwest 10. The cultivar "Meeker" has shown to be less susceptible than other cultivars in British

Columbia 5. The cultivar "Latham" appeared to have resistance to cane Botrytis in Hungary 8. Specific traits of cultivars may help in the selection of more resistant cultivars e.g. some cultivars may have a stigmatic fluid that is inhibitory to *B. cinerea*, thereby avoiding the latent fruit infections 14, 15 and cultivars that flower over a longer period of time may be more susceptible 10.

Cultural practices such as pruning to promote air movement and reduced periods of leaf and flower wetness has been shown to reduce disease development 4. In addition, the consistent removal of as many sources of inoculum as possible, including leaf debris, mummified berries and pruned canes also helps to reduce Botrytis infection 4.

### **Botrytis Research in the Pacific Northwest**

Researchers from Washington State



**Figure 11.** Germinated Botrytis cinerea spore in agar medium.  
Photo Dalphy Hartevelde, WSU

University and Oregon State University are currently studying the timing and environmental conditions required for infection of raspberry canes, flowers and fruit by the pathogen as well as the status of fungicide resistance of *B. cinerea* infecting blueberry, raspberry and strawberry. We are also attempting to determine if different populations or species of *Botrytis* infect berry crops in the PNW and if so, how this might affect disease management strategies. These studies are designed to improve our understanding of the local *Botrytis* populations infecting berries and provide a foundation for improved disease management.

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# TRAP DESIGNS FOR SPOTTED WING DROSOPHILA, WHAT HAVE WE LEARNED?

Jana Lee

USDA ARS, Horticultural Crops Research Unit

Spotted wing drosophila, *Drosophila suzukii*, is an invasive vinegar fly that appeared in Oregon and Washington in 2009. Since then, it has caused substantial problems with fruit damage and increased costs of management. Monitoring traps are steadily being improved, baits are becoming more specific and attractive to this species. There is a wide range of physical designs of a trap for SWD, some of it commercialized, and others being custom-made. As of now, it would be hard to settle on one design, but trap options that have caught more SWD are presented below. Remember: if holes or mesh are on the side of a trap, leave a side portion intact for pouring out the liquid.

There have been some broad comparisons of traps that give us an idea of what works well.

In a 16-site study done throughout North America (Fig. 1), the Haviland and Dreves trap overall caught more flies. When we compared the number of flies captured based on the entry area of the trap (2 holes, 10 holes, top mesh, larger side mesh), more flies were caught as the entry area increased. We would assume that the bait volatiles are stronger coming from traps with greater entry areas, and flies enter those traps more readily.

In a 4-site study, yellow dome traps (Fig. 2) consistently caught more SWD than local traps that comprised of clear deli/cup container with holes. In this case, the dome trap differs greatly in many aspects from the cup trap in color, shape, entry area, orientation of entry area, etc. Also the dome traps used a greater bait volume than the cup traps.

There have been many follow-up studies looking at a specific feature of a trap while keeping other parts of the trap the same, this is to narrow down what features are important for catching SWD. Below is a generalized sum-



**Fig. 1.**  
Multi-site study with 6-7 designs



Fig. 2. Dome trap used a more orange “school bus” yellow.

- Bait volume – Traps that can hold greater bait volume have caught more SWD. More bait means more attractive substance—makes sense.
- Bait surface area – Traps that have greater bait surface area catch more SWD. This feature would be limited by size of the trap. As traps get too big, they are harder to hang in the canopy, and more likely to tip.
- Entry area – As entry area increases in a trap, more SWD are captured. However, this may be counterproductive as the area gets too large. At a certain point, the bait may volatilize too quickly or SWD are more likely to escape from the trap.
- Headspace – distance between the bait and the entry point on the trap (Fig. 3). In some studies but not all, as headspace decreases in a trap, more flies are caught. There are practical considerations, if the headspace is too small, the bait might spill out easily.
- Orientation of entry point – In one study, traps with mesh sides caught more SWD than traps with mesh on the lid. In another study, a trap with holes on the lid under a close-fitting cover caught more SWD than a trap with holes on the side.
- Preventing escape – Addition of soap to some of the baits, like apple cider vinegar, may help catch more SWD. Soap may not be helpful with baits like yeast-sugar-water, as it is a broth of living organisms. Dome traps are thought to

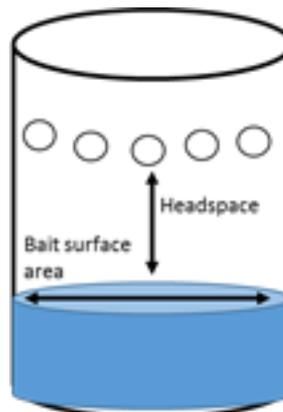


Fig. 3. Trap features

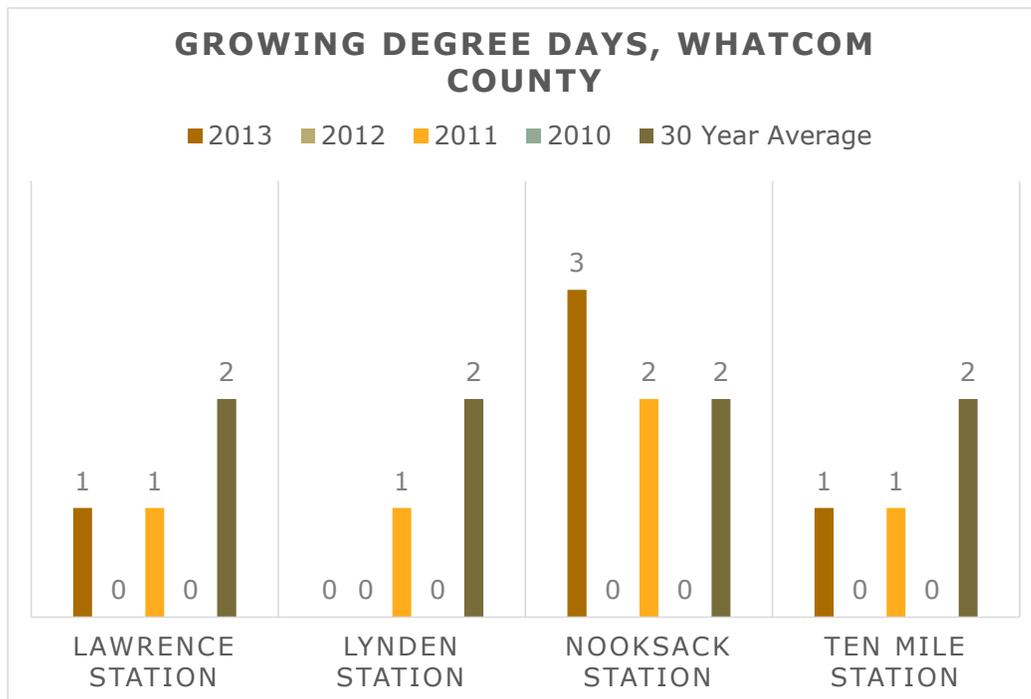
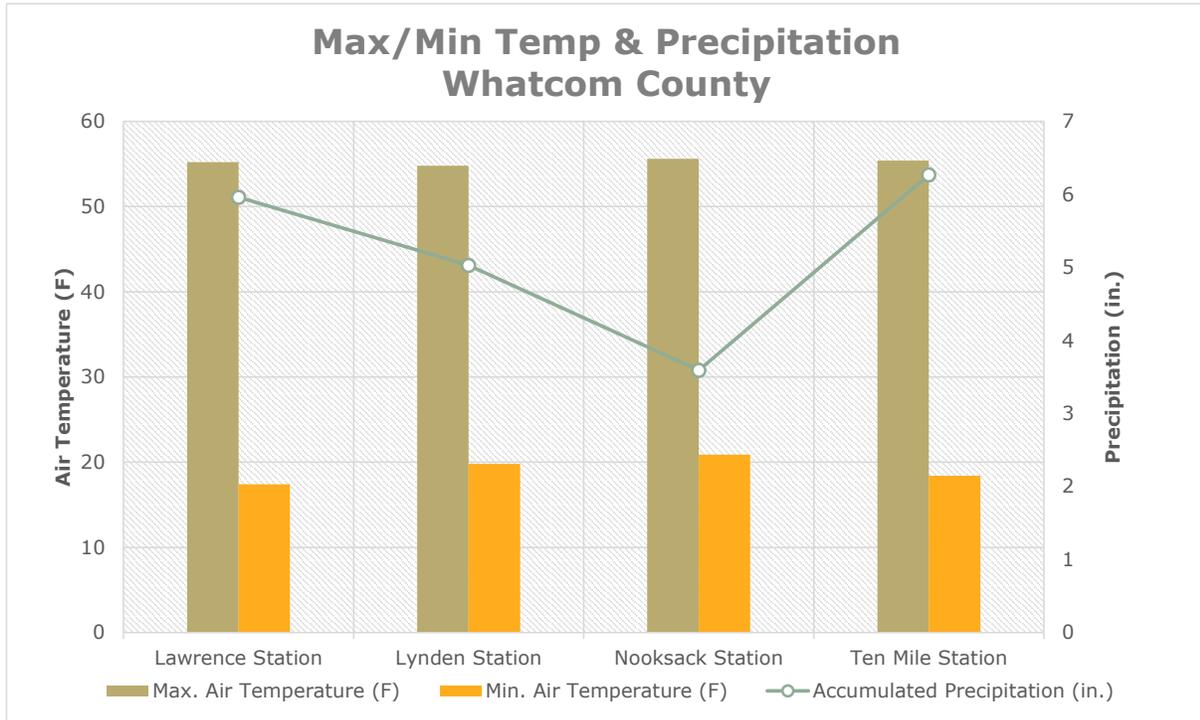
work well because it may be more difficult for SWD to escape from the trap.

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# WEATHER UPDATE

All information here is derived from the four weather WSU AgWeatherNet stations (<http://weather.wsu.edu/awn.php>) in Whatcom County. Current weather conditions can be found at: <http://whatcom.wsu.edu/ag/currentdata.html>. Station information can be found [here](#).



# OSU Blueberry School

March 16th - 17th

Early registration ends February 5th

*Washington pesticide credits applied for and CCA credits available*



## OSU Blueberry School

March 16-17, 2015 · Corvallis, Oregon

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OSU Blueberry Growers' Course Agenda

### OSU BLUEBERRY SCHOOL



**Early registration ends Feb. 5, 2015 – [Register Now](#)**

This two-day blueberry "school" is intended for both new and experienced blueberry growers, farm managers, crew leaders, advisors, packers/shippers, and consultants. Experts from Oregon State University, USDA Agricultural Research Service, Washington State University, and the blueberry industry will address key issues of where the blueberry market is going; how you might be more successful in tight labor or volume markets; which cultivars are easiest to grow and are in most demand; how to establish new acreage using cutting-edge methods; projected costs and the resources available to growers for selecting new planting sites; how to best manage existing acreage to maximize returns of high-quality fruit; basic information on blueberry plant physiology to help growers minimize environmental stresses and improve yield

### Dates

March 16-17, 2015

### Location

The LaSells Stewart Center &  
CH2M HILL Alumni Center  
Oregon State University  
Corvallis, Oregon

### Menu

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# Upcoming Events

## January

[Crop Planning for Organic Vegetable Growers Workshop](#)

Jan 20th  
8:30 am - 4:00 pm  
Mt. Vernon, WA  
This workshop provides a structure for determining how to operate a profitable, diversified vegetable farm. It hones in on the core issues of farm success: which crops to grow, when to plant them, and in what quantities. Then it provides a logical, linear process for completing it all on time.

[Oregon Blueberry Conference](#)

Jan 27th  
8:00 am - 8:00 pm  
Portland, OR  
This day-long conference focuses on blueberries and covers such topics as: blueberry production summary and trends, production systems, and pest management strategies.

[Lower Mainland Horticulture Improvement Association Horticulture Growers' Short Course](#)

Jan 30th - Feb 1st  
Abbotsford, B.C.  
LMHIA organizes an annual Growers' Short Course. Funds raised from registration / membership support horticulture research projects, publication of two Production Guides: Berries and Vegetables, and management of the pesticide re-certification program for our members.

[The Country Living Expo and Cattleman's Winterschool](#)

Jan 31st  
7:30 am - 5:30 pm  
Stanwood, WA  
The Country Living Expo and Cattleman's Winterschool will offer more than 185 workshops and classes in skills from cheesemaking and beekeeping to agribusiness, landscape design and small-scale solar power. Join keynote speaker Dr. Temple Grandin, the world's most famous and influential person with autism and world renowned authority on animal behavior, for this fascinating presentation, on understanding animal behavior and her desire for animals to have more than just a low-stress life.

## February

[State of Cider 2015 & Beyond](#)

Feb 14th  
8:30 am - 3:15 pm  
Everett, WA  
Join the Northwest Agriculture Business Center (NABC) at this one-day seminar to better understand the industry as it exists today, and what actions should be taken to ensure a thriving industry for the future. The keynote speaker is internationally renowned Cider Maker & Educator Peter Mitchell from the UK. Peter will address the state of cider in the world and US markets.

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**Cover Image:**

Newly fall planted lettuce gets going.

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# Upcoming Events

[WSU Basic-Plus Cheese-Making Short Course](#)

Feb 17th – 19th  
8:00 am - 5:00 pm  
Mt. Vernon, WA

This 3-day offering is intended for the beginning cheese maker who is serious about pursuing cheese making as a business activity at the farmstead or artisan level.

Avid hobbyist and enthusiasts are welcome too!

The program includes:

- Opportunities and challenges for the Small Scale Cheese Maker
- Milk sources, composition and quality
- Steps of the cheese making process

[Cider & Perry Orcharding](#)

Feb 24th  
8:30 am – 5:00 pm  
Bow, WA

Northwest Agriculture Business Center/NABC offers a workshop tailor made for the Orchardist wanting to grow cider & perry fruit. Gary Moulton, Pomologist and local orchardist will present on critical issues for marine climate orchardists of these specialty fruits. Also see "Hard Cider Course" below for a list of related classes.

[Grafting Vegetables: Hands-On Workshop](#)

Feb 20th  
9:00 am - 12:00 pm  
Mt. Vernon, WA

Learn how to use the splice-graft technique to graft tomato and

watermelon successfully. Participants will use common rootstocks for each crop and will graft 6 plants of each crop which they can take home to heal.

[Pastured Poultry Production](#)

Feb 20th  
9:00 am – 4:00 pm  
Burlington, WA

Success with pasture-raised poultry requires solid business planning and good application of production techniques. This workshop will provide students with actionable tactics to help streamline their enterprises and maximize profits.

[Understanding Soils and Plant Nutrition](#)

2-day course  
Feb 10th - 11th  
17th - 18th  
24th - 25th  
8:00 am - 5:00 pm  
Parma, ID

This 2-day class will be held at the Lab in Parma, Idaho and will cover the physical, chemical and biological properties of soil. CCA credits will be available for Oregon, Washington, Utah, and Idaho.

[WSU Food Ingredient Technology Short Course](#)

Feb 25th - 26th  
9:00 am - 5:45 pm  
Seattle, WA

This is an introductory course on Food Ingredient Technology (FIT). The short course provides an overview of major food ingredi-

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# Upcoming Events

ents that are used in value-added foods. It provides an overview of the various functionalities of these ingredients, and how they are used in making foods with qualities that are desired by consumers.

[Hands On Pruning Workshop/Orchard Work](#)

Mar 6th  
9:00 am – 3:00 pm  
Mt. Vernon, WA  
Bring your loppers, hand pruners, saws and safety glasses to this 1-day workshop that will not only give class room instruction, but also hands-on experience in the orchard to help you make good pruning choices. Gary Moulton, Pomologist and Orchardist will instruct students on the science, principles and practices of pruning in the classroom.

[OSU Blueberry School](#)

Mar 16 & 17th  
Corvallis, OR  
The Oregon State University Blueberry School will be held March 16-17, 2015. This two-day "school" is intended for both new and experienced blueberry growers, farm managers, crew leaders, advisors, packers/shippers, and consultants. Experts from Oregon State University, USDA Agricultural Research Service, Washington State University, and the blueberry industry will address key issues Information throughout the program will address the needs of conventional, transitional, and organic growers.

[Season Extension Strategies](#)

Mar 20th  
8:30 am - 4:30 pm  
Burlington, WA  
Technologies & Techniques to help specialty crop producers take advantage of shoulder seasons and year-round markets. Growers will share their experience, knowledge, skills and lesson learned in the areas of variety selection, timing, rotations, storage, use of floating row cover, low and high tunnels, and keeping concise records for tracking, analysis and planning.