WASHINGTON STATE UNIVERSITY
WHATCOM COUNTY EXTENSION

Western Region
Sustainable Agriculture Research and Education

Scouting and Thresholds for Blueberry Pests and Diseases

This field guide is intended to be used as a tool to aid in sampling and decision-making for managing key insect, mite, and disease pests in blueberry fields. It compiles information from numerous written sources, practical pest scouting experience of growers in Whatcom County, and information gathered from a consensus meeting of growers and industry representatives in 2008.

The guide is organized based on crop stage and pest development because this is the way the grower or scout encounters blueberry pests and decides how to manage them. The crop stages are divided into five periods:

- Pre-Bloom (February - April)
- Bloom (Late-April to May)
- Pre-Harvest (June - July)
- Harvest (July - September)
- Post-Harvest (September - October)

Pest monitoring guidelines are provided for each pest, as well as thresholds and management tools when they are applicable. Monitoring guidelines relate to the scouting record sheets which are available on the Blueberry IPM Manual Web site through WSU Whatcom County Extension.

Regular field scouting is an important component of any IPM program. By performing some of the basic scouting and record-keeping procedures outlined in this manual, growers can be more informed and more involved in pest management decision-making.

Regular systematic scouting and recordkeeping is the fundamental component of Integrated Pest Management. The scouting season typically begins in early March prior to the onset of bloom with four to five trips during pre-bloom and bloom, two to three trips pre-harvest, and two to three trips during harvest and post-harvest. Eight to ten well-timed trips through the field for the entire season are usually enough to provide valuable information on which to base decisions. Scouting and recordkeeping takes about an hour for each field visit. This represents a total, season-long investment of eight to ten hours per field.

Fields should be checked on approximate two week intervals from late March through late June (six to seven visits) prior to the onset of harvest. Sampling during harvest is difficult due to time constraints but careful observations of insects that may be present on the harvesting belt is a form of scouting as well. Fields should be checked on approximate two week intervals starting immediately after harvest and into early September (two to three visits).

Introduction continued on back page…

For more information on Blueberry IPM in Northwest Washington, see the Blueberry IPM Manual online at: http://whatcom.wsu.edu/ipm/small_fruit.html

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Pre-Bloom

General Guidelines for Scouting in Blueberry Fields

Visit three to five sites in each block (field or portion) depending on block size. Sites should be distributed throughout the block and effort should be made to return to those approximate areas for each visit.

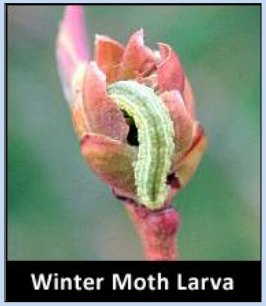
At each site, visit 10 to 20 bushes spaced 3-5 plants apart on both sides of the row. At each plant, follow the monitoring guidelines. Scouting should occur during regularly planned scouting trips as well as during general trips to the field.

Aphids

- Inspect 5 leaves per plant.
- Look at undersides of leaves and inside the curled leaves of terminal shoot growth.
- Record number of leaves with over 5 aphids; early scouting numbers will develop trends for later in season.
- Aphids prefer leaves with high levels of Nitrogen. Excessive Nitrogen fertilization will encourage aphid populations.
- Beneficial insects should keep low numbers of this pest in check.
- Pre-bloom treatment is recommended in scorch virus areas; usually not needed in non-scorch areas.

Winter Moth and Bruce Spanworm

- Inspect 5 shoot tips per plant.
- Evidence of feeding activity includes silk, frass, discolored buds, and chewed entrance holes in the sides of buds.
- Record number of buds infested or showing feeding damage.
- Consider treatment if 5-10% of bushes have infested buds. Insecticide treatments should target hatching larvae.



Winter Moth Larva

Bruce Spanworm Larva

Mummyberry

- Scrutinize the soil at base of plants and record level of mummyberry (none, low, med, high)
- February: rake soil, look for fallen mummified berries. Open berries, look for developing spore cup which looks like a germinating seed
- March: monitor for mushroom-like spore cups on soil surface. Peak spore production usually occurs shortly after bud break.
- Scout for primary infection on the newly emerged leaves (seen as blackening in the center of the leaf). The leaves will wilt quickly and the twig tips will bend. Grayish green tufts of fungus are associated with the wilted foliage and blackened stems.

Management:

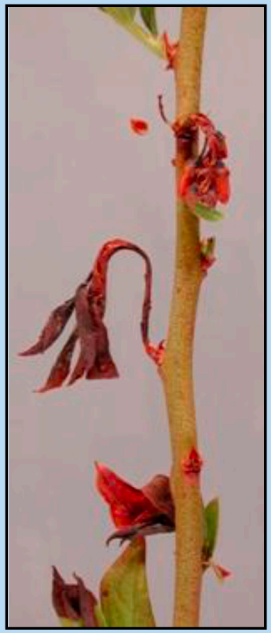
- Prior to budbreak, shallow cultivation will prevent spore cup development, but will not be effective if sawdust mulch is used.
- Mummies can be covered with soil or mulch at least 2 inches deep.
- Avoid wet sites and overhead irrigation until petal fall.
- Consider treatment if spore cups are found at 10-20% of bushes and weather conditions are wet and above 50°F.

Photo by Sonja Ring

Godronia Canker

- Inspect several stems per plant for evidence of infections on flower buds.
- Cankers have small reddish-brown blemishes.
- Record number of plants with symptoms.
- Godronia is spread through wet weather in spring and fall.

- New lesions found in the spring signify infection from last fall.
- If new lesions are found, prune and destroy infected stems as much as possible and consider a fungicide treatment to coincide with fall rains.



Blueberry Shock Virus

- Record the number of plants that exhibit symptoms and tag these plants. Also tag other suspected plants seen during other activities.
- Blueberry shock virus symptoms are very similar to blueberry scorch virus; test suspect plants immediately. Testing is done at USDA-ARS in Corvallis Oregon for a small fee. Contact your extension office for more information on testing.
- Symptoms: flowers and new leaves unexpectedly dying on a single branch or through the entire plant.

Management:

- Rogue diseased plants in larger fields with isolated areas of the disease, otherwise, let the disease run it's course.

Botrytis

- Examine 5 branch tips per plant.
- Look for branch tips that are grayish and brittle or dried-up.
- Record number of plants showing symptoms.
- Branch tips killed by winter injury are easily infected.

Management:

- Remove infected plant material.
- Avoid excessive use of nitrogen fertilizer in the spring.
- In areas with high levels of infection, treat during bloom and fruit ripening.

Bacterial Blight / Canker

- At each plant, look for blighted tips or cankered twigs, especially when frost has occurred. Record number of plants showing symptoms.
- Symptoms are similar to Blueberry Scorch Virus and *Botrytis* mold. Send samples to be tested if unsure.

Management:

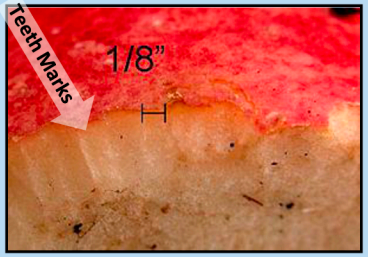
- Prune out diseased wood as soon as possible.

Voles

- Set-up monitoring stations: cover runway or tunnel entrance with a shelter made of roofing shingle or PVC piping (4-8 stations per acre).
- Place apple wedge bait under shelter; check apple bait daily for 2-3 days for feeding damage.
- Record % of stations positive for feeding damage.
- Monitor again 2-3 weeks after treatment to determine efficacy .

Management:

- Treatment threshold: 20-40% positive from monitoring station.
- Remove debris piles, regularly mow field margins, keep large weeds under control.
- Pelletized baits can be broadcast, but degrade quickly.
- Bait stations can be made by making a "T" out of 2-3 inch PVC pipe filled with bait. *For further details: http://whatcom.wsu.edu/ipm*



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Bloom

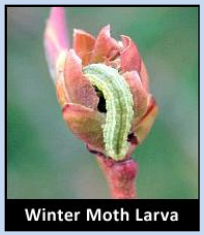
General Guidelines for Scouting in Blueberry Fields

Visit three to five sites in each block (field or portion) depending on block size. Sites should be distributed throughout the block and effort should be made to return to those approximate areas for each visit.

At each site, visit 10 to 20 bushes spaced 3-5 plants apart on both sides of the row. At each plant, follow the monitoring guidelines. Scouting should occur during regularly planned scouting trips as well as during general trips to the field.

Aphids

- Inspect 5 leaves per plant; record number of leaves with over 5 aphids
- Look at undersides of leaves and inside the curled leaves of terminal shoot growth.
- Beneficial insects should keep low numbers of aphids in check.
- Consider treatment if more than 50% of leaves have more than 5 aphids per leaf in non-scorch areas; over 10% in scorch areas



Winter Moth Larva

Bruce Spanworm Larva

Wintermoth and Bruce Spanworm

- Small larvae can be found inside the flower and in clusters.
- Inspect 5 flower clusters per plant. Record number of buds infested or showing feeding damage.
- Evidence of feeding includes discolored buds, silk, frass, chewed entrance holes in the sides of buds.
- Consider treatment if 5-10% of bushes have infested buds. Be cautious of treatments that disrupt pollinators.

Gall Midge

- Adults emerge in May-June & oviposit in terminal growth.
- Eggs hatch in a few days, larvae feed in terminal buds.
- Beginning in May; look for blackened tips of unfolding leaves of terminal growth, use hand lens to inspect tip for small maggot.
- Inspect 5 shoot tips/plant. Record % of infection.
- Record trends; no thresholds are currently available.
- Prune out damaged branches to promote normal growth.

Leafrollers

- All life stages are present, larvae roll up leaves; second generation moths begin to emerge in late May.
- Place pheromone traps in fields beginning in late April or May and check weekly.
- One week after peak flight, examine leaves and flowers for worm infestation weekly by pulling leaves and flower clusters apart.
- Inspect 5 flower clusters per bush and record # of caterpillars found

Root Weevils

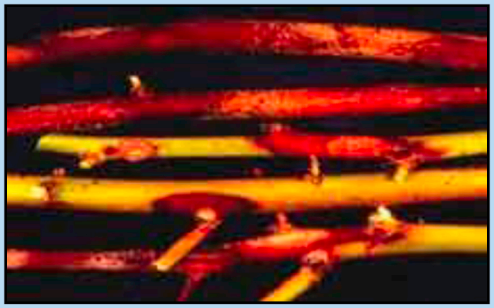
- Adults of many species are emerging at this time
- Look for plants with reduced vigor.
- At several places at each site, dig around base of plant to look for grubs; record # of grubs found in soil around 10 plants.
- After May, look for notching on lower leaves and new shoots; record damage on scale of 1-5.
- At night, shake plant onto a light colored cloth to look for adults.
- During the day, find adults in debris around base of plant.

Voles

- Continue monitoring using monitoring stations with apple baits.
- Record % of stations with positive feeding damage.

Birds

- Scout for birds in early morning or just before dusk. Identify type of bird and number present and change in population size.
- Several types of management options are available. A management plan should be developed that is appropriate to farm site and surrounding properties.



Godronia Canker

- Inspect several stems per plant for evidence of cankers. Record number of plants with symptoms.
- Cankers are seen as small reddish-brown blemishes
- Godronia is spread through wet weather in spring.

Management:

- Prune and destroy infected stems
- Consider fungicide treatment in early fall

Botrytis

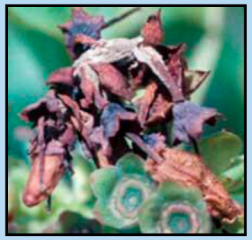
- Examine 5 branch tips per plant.
- Inspect 5 flower clusters per plant, especially during wet weather. Look for a brown, water-soaked appearance. Blossoms may also be covered with gray fuzzy mold. Record # of infected plants.
- Branch tips killed by winter injury are easily infected.

Management:

- Keep an open canopy to increase air circulation

Mummyberry

- Infected leaves will flag and turn brown
- Infected blossoms will turn brown and wither
- Inspect leaves on 5 shoots per plant for infected leaves; record % of shoots infected.
- Consider treatment when conidia (grayish-green tufts of fungus) are present to avoid secondary infection of flowers and fruit.



Blueberry Shock Virus

- Symptoms: flowers and new leaves unexpectedly dying on a single branch or through the entire plant.
- Record number of plants that exhibit symptoms and tag these plants. Tag suspected plants seen during other activities.
- Blueberry shock virus symptoms are very similar to blueberry scorch virus; test suspect plants immediately. Testing is done at USDA-ARS in Corvallis.
- ***Management:***
  Rogue diseased plants in larger fields with isolated areas of the disease, otherwise, let the disease run it's course.

Blueberry Scorch Virus

- Symptoms are similar to shock virus but plants do not recover
- Look for suspicious plants during scouting as well as during other field activities.
- Tag plants and get tested by USDA-ARS in Corvallis.

Bacterial Blight / Canker

- Reddish-brown to black cankers may have developed from winter infections.
- Infection occurs on previous season's growth.
- Record # of symptomatic plants
- Send samples to lab for diagnosis

Management:

Prune out diseased wood

Anthracnose

- Look for orange spore masses on last year's fruit stems.
- Record # of symptomatic plants
- This is a fruit disease; thresholds are dependant upon post harvest usage.

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Pre-Harvest

General Guidelines for Scouting in Blueberry Fields

Visit three to five sites in each block (field or portion) depending on block size. Sites should be distributed throughout the block and effort should be made to return to those approximate areas for each visit.

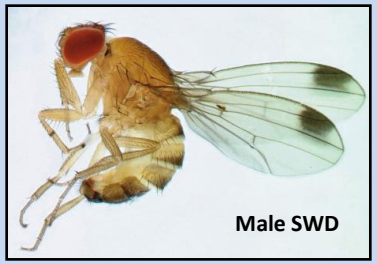
At each site, visit 10 to 20 bushes spaced 3-5 plants apart on both sides of the row. At each plant, follow the monitoring guidelines. Scouting should occur during regularly planned scouting trips as well as during general trips to the field.

Aphids

- Inspect 5 leaves per plant; record number of leaves with >5 aphids.
- Look at undersides of leaves and inside the curled leaves of terminal shoot growth. Also look for mummified aphids and beneficials.
- Beneficial insects should keep low numbers of aphids in check.
- Consider treatment if more than 50% of leaves have more than 5 aphids per leaf in non-scorch areas; over 10% in scorch areas.

Leafrollers

- Leaves may be rolled, chewed, and tied together with silk at this time and may be attached to fruit clusters with silk.
- Inspect 5 flower clusters per plant; pull apart clusters to confirm presence of caterpillars. Record number of larvae or damaged leaves found.



Male SWD

Winter Moth Larva

Bruce Spanworm Larva

Wintermoth and Bruce Spanworm

- Maturing larvae feed on emerging foliage and developing fruit through June or July.
- Inspect 5 fruit clusters per plant. Look for webbing or frass in the fruit cluster. Record number of buds infested.
- Consider treatment if 5-10% of bushes have infested buds. Be cautious of treatments that may disrupt pollinators.

Spotted Wing Drosophila

- Male SWD flies have a small dark spot on the front edge near the tip of each forewing.
- Set-up container traps containing apple cider vinegar. Place traps in the field. Monitor traps at least once/week, 2x/week when fruit is ripening and look for adults in the traps.
- Also monitor for small puncture (oviposition scar) wounds on fruit and soft fruit. Adults are attracted to ripe or ripening fruit.
- This pest is new; thresholds and management are not established; current threshold is detection.

Root Weevils

- Look for plants with reduced vigor.
- Inspect 20 plants per site for evidence of adult leaf feeding which appears as notching of leaves and flagging of stems. Record damage on scale of 1-5.
- Consider treatment if plants show signs of low vigor and weevils have been found or if plants show excessive feeding damage.

Gall Midge

- Adults emerge in May -June & oviposit in terminal growth.
- Eggs hatch in a few days and larvae feed in terminal buds
- Inspect 5 shoot tips/plant at each site; look for blackened tips of unfolding leaves of terminal growth, use a hand lens to look for small maggot.
- Record # of damaged shoot tips or presence of larvae.
- Observe trends; no thresholds are currently available
- Prune damaged branches to promote normal growth

Birds

- Scout for birds in early morning or just before dusk. Identify type of bird and number present and change in population size.
- Several types of management options are available. A management plan should be appropriate to farm site and surrounding properties.

Godronia Canker

- Inspect several stems per plant for evidence of cankers. Record number of plants with symptoms.
- Cankers are seen as small reddish-brown blemishes.

Management:

- Prune and destroy infected stems.
- Consider fall fungicide treatment.

Blueberry Shock Virus

- Plants infected with Shock Virus may be showing new growth at this time. Blighted blossoms may still be on the plant or they may have fallen to the ground.
- Record the number of symptomatic plants and tag these plants. Tag other suspected plants seen during other activities. Test these plants for Scorch Virus.

Blueberry Scorch Virus

- Plants infected with scorch virus will not be recovering at this point like shock infected plants.
- Look for suspicious plants during scouting as well as during other field activities.
- Tag plants and get tested by USDA-ARS in Corvallis.

Bacterial Blight / Canker

- Infection levels increase during wet springs and on springs with winter injury.
- Inspect plants for blighted tips and cankered twigs.
- Record # of symptomatic plants.
- Symptoms can resemble those of Scorch Virus and Botrytis Blight; send samples to lab for diagnosis

Management:

Prune out diseased wood

Botrytis

- Inspect 5 fruit clusters per plant for fuzzy gray mold. Record level of infection (low, medium, high).
- Inspect 20 plants per site for infected shoot tips. Record # of infected plants.

Management:

- Apply fungicides during bloom and fruit ripening.

Mummyberry

- Infected fruit will show white growth in interior of fruit and may fall to the ground before harvest.
- Inspect 5 fruit clusters per plant.
- Look for early "ripening" of the fruit, where healthy fruit are green and infected fruit are turning a reddish color. Record number of clusters with symptoms.
- Cut open 10 fruit; look for whitish growth inside berry.
- Record # of infected fruit.
- Treatment is not effective at this stage, but scouting can determine disease pressure for next season.

Alternaria Fruit Rot

- Infected ripening fruit will show symptoms of caving in on one side with dark gray-green spore growth.
- Inspect 5 fruit clusters per plant.
- Record level of infection (low, medium, high)
- Consider treatment if infection is medium or high.

Anthracnose

- Look for orange spore masses on last year's fruit stems.
- Inspect 5 fruit clusters per plant.
- Record # of symptomatic plants.
- This is a fruit disease; thresholds depend on processing type.

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Harvest

General Guidelines for Scouting in Blueberry Fields

Visit three to five sites in each block (field or portion) depending on block size. Sites should be distributed throughout the block and effort should be made to return to those approximate areas for each visit.

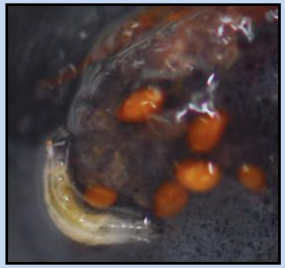
At each site, visit 10 to 20 bushes spaced 3-5 plants apart on both sides of the row. At each plant, follow the monitoring guidelines. Scouting should occur during regularly planned scouting trips as well as during general trips to the field.

Aphids

- Aphids continue to produce offspring until late fall, but rate of population increase is lower.
- Inspect 5 leaves per plant; look for winged and wingless aphids as well as aphid mummies that have been parasitized. Look for beneficial insects such as ladybug larvae, lacewing larvae, and syrphid larvae.
- Presence of honeydew and sooty mold on fruit and leaves indicates a high aphid population.
- Beneficial insects should keep low numbers of aphids in check.
- Record # of leaves with over 5 aphids, # mummified aphids, and beneficial insects found.

Spotted Wing Drosophila

- Male SWD flies have a small dark spot on the front edge near the tip of each forewing.
- Set-up container traps containing apple cider vinegar. Place traps in the field. Monitor at least once/week, 2x/week when fruit is ripening and look for adults in the traps.
- Also monitor for small puncture (oviposition scar) wounds on fruit and soft fruit. Adults are attracted to ripe or ripening fruit.
- This pest is new; thresholds and management are not established; current threshold is detection.



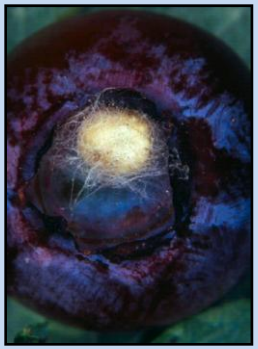
Birds

- Scout for birds in early morning or just before dusk. Identify type of bird and number present and change in population size.
- Continue monitoring through harvest.
- Several types of management options are available. A management plan should be developed that is appropriate to farm site and surrounding properties.
- A successful bird management plan will include several deterrent techniques and will be sensitive to residential neighbors.
- Adapt management plan according to scouting levels.

Mummyberry

- Infected berries will show up in the clusters and drop to the ground to overwinter.
- Mummyberries first appear pink and puckered looking; the inside tissue is brown and corky; it turns white and withered and dried as it ages.
- At each plant, check 5 berry clusters for mummyberry symptoms.
- Examine the ground beneath the plants to see if any infected fruit has fallen.
- Rate # of mummyberry found (low, med, high).
- On small farms, dropped fruit should be cleaned up following harvest.

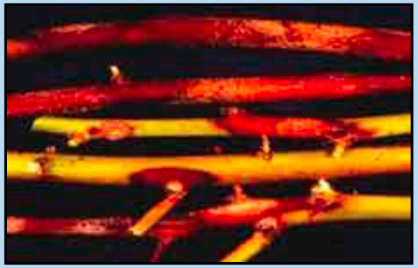
Fruit Contaminants



- Primarily egg sacks of spiders or pupae of lacewing or syrphid flies contained in the blossom end of the berry appearing as a white furry mat in the calyx end of the fruit.
- Many of these are considered beneficial, so control is not recommended.
- Inspect 5 fruit clusters per plant for contaminants.
- Record this number and train harvesting and processing crew to be aware of contaminants and to remove them on the harvesting and grading lines.

Godronia Canker

- Cankers are still growing in size through the season and will start to appear more like a bull's eye, with gray centers and a reddish-brown outside.
- Look for leaves turning color earlier than normal. These leaves will turn bright red/brown and remain attached, looking like red flags in the field.
- Record # of symptomatic plants.
- Prune and destroy infected stems.



Botrytis

- Botrytis becomes more active on fruit as they ripen.
- Inspect 5 fruit clusters per plant for fuzzy gray mold. Record # of infected fruit clusters.
- Fruit should be harvested frequently where gray mold is commonly seen, especially in conditions of wet and warm weather.

Blueberry Shock Virus

- Infected plants appear normal in late Summer except for the lack of fruit.
- Visit marked plants to observe recovery from shock virus.
- Samples of plants not recovering should be sent to diagnostic lab immediately to test for scorch.

Blueberry Scorch Virus

- Plants infected with scorch virus will not be recovering at this point like shock infected plants.
- Symptoms include leaf dieback and lighted blossoms remaining on the plant.
- Send samples of symptomatic plants to diagnostic lab immediately.

Alternaria Fruit Rot

- Infected fruit will not show symptoms until fruit is ripening or even until in storage.
- Symptoms include caving in on one side with dark gray-green spore growth.
- Inspect 5 fruit clusters per plant. Record whether level of infection is low, medium, or high.
- Avoid over-ripening by harvesting often. Cool fruit immediately following harvest.

Anthracnose

- Ripening infected berries will show symptoms of the blossom end softening and masses of salmon colored spores.
- Inspect 5 fruit clusters per plant for level of infection. Record level as low, medium, or high.
- To reduce spread among harvested fruit, reduce fruit temperature to 32˚F as soon as possible.

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Post-Harvest

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At each site, visit 10 to 20 bushes spaced 3-5 plants apart on both sides of the row. At each plant, follow the monitoring guidelines. Scouting should occur during regularly planned scouting trips as well as during general trips to the field.

Aphids

- Natural predators should have aphids under control at this stage.
- Inspect 5 leaves per plant for aphids, especially winged aphids. Record number of leaves with over 5 aphids.
- Consider treatment if scorch virus is present in your area and population of winged aphids is not decreasing.

Tent Caterpillars and Fall Webworms

- Tents of Fall Webworm may be present until the middle of September. Larvae will drop to the leaf litter to pupate and overwinter in the soil.
- Tent Caterpillars will overwinter as egg masses on stems.
- Record # of plants with egg masses.
- Inspect branches for overwintering egg cases that appear as brown or gray hardened foam-like substance.
- Hand-pick or prune out branches with egg masses.
- Dormant oils may be applied in January and February to kill the eggs.

Root Weevils

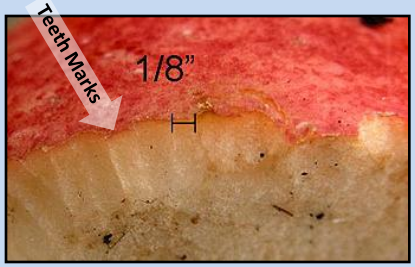
- Weevils overwinter as larvae or adults.
- Check for adult Obscure root weevil leaf feeding by looking for notching damage. Record level of damage (low, med, high)
- Shake adults out of plant onto white cloth on the ground. Record # of obscure weevils found in foliage.
- Inspect soil for larval root weevils; dig around root zone of 10 plants to look for c-shaped grubs. Record # of grubs found.
- If root weevil damage has been detrimental or levels are high, consider applying a nematode application in early Autumn when soil temperatures are still warm and larvae are young.

Voles

- Fall monitoring is done to determine populations before winter when crop damage can occur.
- Set-up monitoring stations: cover runway or tunnel entrance with a shelter made of roofing shingle or PVC piping (4-8 stations per acre).
- Place apple wedge as bait under shelter; check apple bait every day for 2-3 days for feeding damage.
- Record % of stations positive for feeding damage.
- Monitor again 2-3 weeks after treatment to determine efficacy

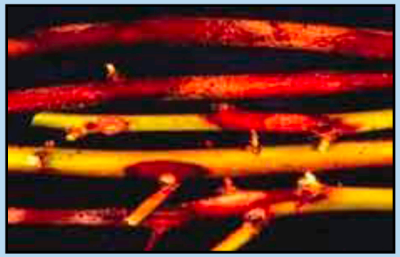
Management:

- Treatment threshold: 20-40% positive from monitoring station.
- Remove debris piles, regularly mow field margins, keep large weeds under control.
- Pelletized baits can be broadcast, but degrade quickly.
- Bait stations can be made by making a T out of 2-3 inch PVC pipe filled with bait. *For further details: http://whatcom.wsu.edu/ipm*



Godronia Canker

- Red flags of dying leaves may be seen in infected plants.
- Record level of infection (low, med, high).
- Prune out infected wood and educate crew on how to identify infection and prune out infected wood.



Botrytis

- Infected stem tips may appear gray or tan and dried out.
- Black sclerotia may also be seen.
- Record level of infection (low, med, high).
- Prune out infected wood.
- Keep canopy open to encourage good air circulation.

Mummyberry

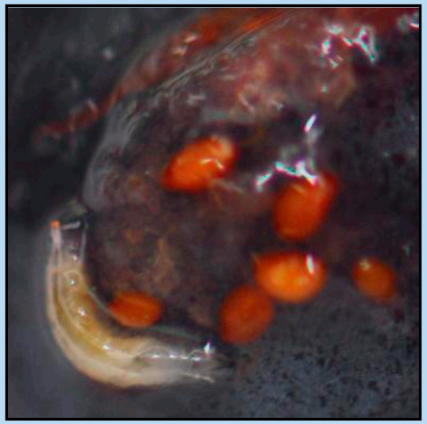
- Infected berries will have dropped to the ground by this time.
- Scout for mumyberries fallen to the ground.
- Record level of mummyberries fallen (low, medium, high).
- Consider cultural treatment at this time.
- After harvest and before leaf drop, cultivate shallowly to bury mummies. Berries that are buried 1" have been found to not cause infection the following year.

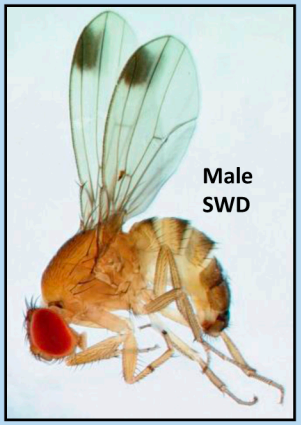
Blueberry Shock Virus

- Infected plants appear normal in late summer except for the lack of fruit.
- Visit marked plants to observe recovery from shock virus.

Spotted Wing Drosophila

- This pest is new and thresholds and management have not been developed.
- Management recommendations include good harvest and sanitation practices. Dropping fruit to rot or leaving incompletely harvested fruit in the field is strongly discouraged.
- Adults are attracted to dropped and decaying fruit and will feed on it.





Bacterial Blight

- Reddish black to brown cankers may still be seen.
- Record level of infection (low, med, high)
- Prune out infected wood and educate crew on how to identify and prune out infected wood.

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Blueberry Natural Enemies

Natural enemies of pests are often present in the landscape and can assist with pest control. To conserve beneficial insects, select pesticides cautiously; avoid pesticides that will also kill beneficial insects. Scout for natural enemies as well as pest species to understand the relationship between the two in a field; often the beneficial insects can keep a pest population in check.

Many beneficial insects thrive in areas with a diversity of plant species; they often use plants for pollen and nectar sources and for shelter. Consider providing these types of plants, especially those with several small flowers and a diversity so that flowers are available all season.

Aphid Midge (*Aphidoletes sp.*)

- Midge adults are small (2-3mm) delicate flies, and are attracted to aphid honeydew; they do not feed on aphids
- Midge larvae are predators of aphids. They have two anal spiracles that pierce the aphid and feed on the aphid.
- Larvae are orange-brown and 2-3mm long.
- This predator prefers high humidity and shelter from high temperatures. A source of honeydew or nectar will increase adult egg laying.
- Most pesticides are toxic to *Aphidoletes*.

Photo by Carolyn Teasdale

Lacewing (*Chrysoperla sp.*)

- Adult lacewings are ½" to ¾" long and feed on honeydew from aphids.
- Lacewing eggs are pale green and found singly on long stalks attached to plant foliage.
- Lacewing larvae are 1/3" long when mature and resemble mini-alligators. They feed on aphids, spider mites, and immature plant bugs.

Photo by W. McDiarmid

Photo by Carolyn Teasdale

Photo by D. Gillespie

Parasitic Wasps (various species)

- Parasitic wasp adults are tiny and lay eggs in many species of aphids.
- The immature wasp feeds inside the aphid host and kills it. Tan aphid "mummies" are left behind. Sometimes an exit hole can be seen.

Lady Beetles

•Both adults and larvae feed on aphids, with some feeding on spider mites.
•Adults are about 3/16” long and larvae are 5/16” long when mature.

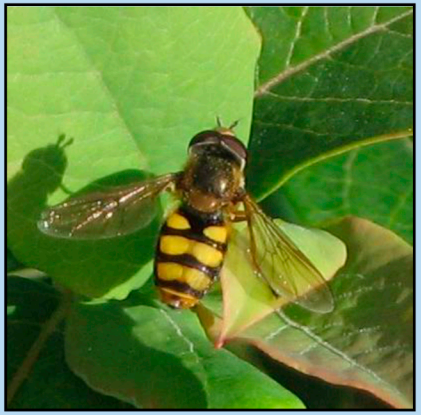
Photo by Carolyn Teasdale (larva)

Photo by Carolyn Teasdale (pupa)

Photo by Carolyn Teasdale

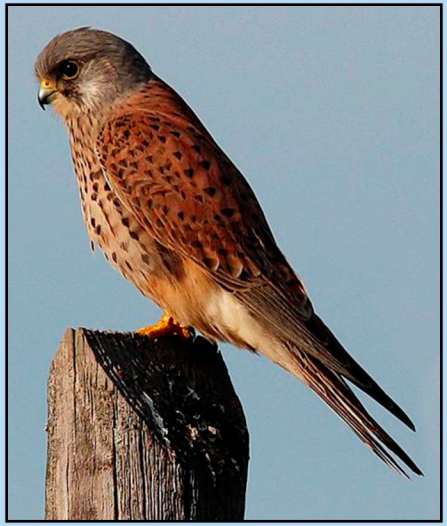
Syrphid Fly

•Adult syrphid fly is about 1/2 inch long. They fly quickly, hover over plants, and feed on pollen, nectar or honeydew.
•Larvae are about 1/2 inch long, usually brown or green with body narrowing toward the head. They feed on aphids.



Raptors for Bird Control

•The use of predatory birds, such as the American Kestrel (Falco sparverius), has been effective in controlling starling populations for some growers. These birds are highly territorial and eat birds, rodents, and large insects. Their presence is a deterrent to problem birds such as starlings.
•Nesting boxes can be used to attract these birds. Food sources should be available. The boxes should be placed in an area near an open field where rodents are present, or in a field with minimal pesticide use to encourage populations of large insects.



Scouting involves performing usually two or three tasks at each of three to five sites in a field. A minimum of three sites should be checked in small fields (<10 acres) and five sites are usually adequate in larger fields (20 acres or more). Sampling in several sites rather than just in a spot or two will illustrate the range or variation of pest abundance found across a field. Recording information on a site by site basis allows the sampler to return at a later time to determine trends in pest population. Use existing knowledge about the field's history or variations which exist within a field to determine sampling site locations. Sites should be distributed throughout a field and the scout should return to those approximate areas for each visit.

At each site, visit 10-20 bushes. These bushes should be spaced 3-5 plants apart and on both sides of the row, in order to cover a larger area at each site.

Scouting for pests and diseases should occur during regularly planned scouting trips, but can, and should, also occur during general trips to the field.

Scouting equipment should include:

- *A Magnifying Hand Lens (10X power)*
- *Scouting report forms*
- *Traps for key pests*
- *A digital camera*

Treatment thresholds for pests in this guide come from published thresholds and those agreed on at a consensus meeting of growers, researchers, and industry representatives in 2008.

Pest and disease treatment thresholds differ between growers, fields, and years; they depend on age of crop, weather, other pest pressures, fruit processing type, price of treatment product, and expected price of fruit. For many of the pests listed in this guide, growers must make decisions based on current scouting information and information from years past. Treatment decisions should include consultation with the processor or buyer.

For some diseases, thresholds are difficult to determine for a single disease, but a threshold for overall disease occurrence can be made. Accurate record keeping of scouting records, treatments made, and results of treatments will help a grower to determine if treatments made in the past were effective and should be used again.

For more information on Blueberry IPM in Northwest Washington, see the Blueberry IPM Manual online at: www.whatcom.wsu.edu/ipm/manual/blue

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