



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 raspberry 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.

The guide is organized based on crop stage and pest development because this is the way the grower or scout encounters raspberry pests and decides how to manage them.

The crop stages are divided into six periods:

- •Dormant / Pre-Bloom (March)
- Pre-Bloom (April mid May)
- •Bloom (Mid late May)
- Pre-Harvest (June)
- Harvest (July early August)
- Post-Harvest (August September)

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 Raspberry 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 late March or early April with an assessment of cutworm damage to developing buds and ends in early September with nematode sampling. 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).

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For more information on Raspberry IPM in Northwest Washington, see the Raspberry IPM Manual online at: http://whatcom.wsu.edu/ipm/manual/rasp





### **Dormant/Pre-Bloom**

March

#### **General Guidelines for Scouting in Raspberry 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 hills spaced 3-5 hills apart and 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.

#### **Climbing Cutworm**

- Examine 5 buds and new shoots at each hill
- Record # of buds/shoots damaged by cutworms or weevils
- Where damage is found, search base of plant during day to identify the pest. If not found, check at night with a flashlight when worms are active.
- •Worm is up to 1 ½ inch long with pale brown to ashy gray body
- •Low tolerance for this pest; few insects can cause yield loss





#### Weevils

- •Check soil around base of plants for weevil larvae
- Examine buds and new laterals for signs of damage from the clay colored weevil
- Record # of buds/shoots damaged by cutworms or weevils
- Plan on summer treatments if weevils are commonly found







#### 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 inches PVC pipe filled with bait. For further details:

http://whatcom.wsu.edu/ipm/manual/rasp







#### **Raspberry Crown Borer**

- Monitoring is difficult because it is hidden in crowns and canes
- •Pay particular attention to weak areas in the field which have smaller, spindly canes or canes that break at the base when tying up to the wire in the winter and spring
- Train pruning crew to report suspect canes
- Examine lower canes and crown area for this insect. Record incidence of pest
- •First year caterpillars are white about ¼" long. Second year caterpillars are white, up to 1 inch long
- •Treatments are made post-harvest

#### Spur Blight (Cane Disease)

- Examine canes at each site for cracked gray areas around buds
- •Tiny black pimples form in affected areas
- Record % of hills infected

#### Management:

- •Cultural practices can impact incidence of spur blight. To reduce disease pressure:
  - Keep weeds controlled around plants
  - Reduce the number of primocanes
  - Remove and destroy old fruiting canes after harvest
  - Avoid overhead irrigation
- •A suggested threshold is to consider treatment if 10% of hills infected after harvest the previous season
- Disease is initially managed by a delayed dormant lime-sulfur application, followed by 2 to 3 early summer fungicide applications



#### Cane Blight (Cane Disease)

- Examine canes at catcher plate height by scraping bark away to see vascular tissue
- •Infected tissue appears as reddish lesion up the cane from a wound site
- •Record % of hills infected

#### Management:

- Cultural practices that increase prevalence of cane disease include:
  - High levels of N fertilizer
  - High cane densities increase humidity and mechanical injury
  - Over-irrigation increases relative humidity to promote disease occurrence
- •Damage by machine harvesters is a key entry point for cane blight. To reduce this impact:
  - Line up hills in the row
  - Ensure catch plates swing easily
  - Train drivers to drive straight
- •If 1-3% of canes are infected, consider treatment
- •Time fungicide applications immediately after harvest, inspection during the dormant and prebloom period confirms presence of the disease





#### **Phytophthora** Root Rot

- Note any low areas which remain wet, particularly after winters of heavy rainfall
- Return to these areas in June with onset of hot weather to evaluate root rot symptoms

#### Management:

- Cultural practices can impact incidence of root rot. To reduce disease pressure, consider:
  - •Use higher raised beds
  - Reduce compaction in these areas of the field
  - Avoid over irrigating
- •Soil-applied fungicides should not be used as a preventative unless *Phytophthora* symptoms are present and the disease-causing organism has been identified through laboratory analysis of root and crown tissue
- Soil-applied fungicides for *Phytophthora* are not effective against other root rot causing organisms. They only reduce symptoms of the disease and do not kill the pathogen itself.





# Pre-Bloom

(April – Mid-May)

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At each site, visit 10 to 20 hills spaced 3-5 hills apart and 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.

#### **Beating Tray Sampling Method:**

Use beating tray to *survey the canopy* for several insect pests that can directly damage fruit or may pose problems as harvest contaminants as well as for beneficial insects. At each site, take ten tray *samples and record* the total number of each pest and beneficial insect dislodged from foliage. Hold tray one foot below trellis wire within canopy and shake foliage by grasping wire and shaking, or striking top wire three times with rubber sprayer hose to dislodge insects. Alternate samples between rows and check about every ten feet down the row.

#### **Clay Colored Weevils**

- •Inspect 5 buds or shoots per plant and look for leaf flagging, bud damage, and leaf notching
- •Record # of buds or shoots with damage
- •If you suspect this insect is present at damaging levels, sample at night using a beating tray to confirm
- •Consider summer treatment with detection of 1 weevil / 10 beating trays
- Check soil around base of plants for weevil larvae to determine life stage present



#### **Climbing Cutworm**

- •Pay attention to areas with less shoot growth
- •Examine several buds and new growth at each hill
- Where damage is found, search base of plant during day to identify the pest If not found, check at night with a flashlight when worms are active
- •Worm is up to 1 ½ inch long with pale brown to ashy gray body
- Raspberries have the ability to suffer some damage from this pest, but moderate counts can cause significant damage. Monitor weekly to determine acceptable level of damage.





#### Western Raspberry Fruitworm or Raspberry Beetle

- •Record the number of adults from beating tray samples
- •Pay attention to interveinal feeding damage on new primocanes
- •Consider treating adult beetles prior to bloom if detected at most sites. Tolerances vary with processing type.
- Monitor adult flight activity with white sticky traps, such as the Rebell Bianco®. Locate traps along field edges.
- •Check traps weekly and record # of beetles per trap
- •Consider treatment if average beetles per trap are above 2 for IQF and above 5 for other processed fruit
- •Record # of raspberry beetles in beating tray samples





#### **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 monitoring stations
- •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/manual/rasp



#### **Raspberry Crown Borer**

- Crown borer caterpillars feed on and within lower canes and crowns
- Feeding causes swelling or galls at or below soil surface
- Examine lower canes and crown area for this insect
- •Train pruning crew to report canes that break at base of hill, to reveal feeding gallery
- Record incidence of pest
- First year caterpillars are white and about ¼ inch long. Second year caterpillars are white and up to 1 inch long.
- •Treatment is done at adult flight post-harvest



#### Spider Mites: Two-spotted (TSSM) and Yellow (YSM)

- Start sampling in early May
- •Collect ten leaflets per site
- •Examine leaves using a 10X hand lens for presence of mites, eggs, and mite predators
- •Count the number of spider mites and mite predators and record information at each site. Predators may be able to take care of low numbers of mites. Monitor relative levels of spider mites and predators. YSM emerge earlier than TSSM. Adult females are pale yellow or greenish with dark food spots on the body. They produces very little webbing. Feeding symptoms are more concentrated yellowish brown coloration
- •White speckling of leaves is a sign of TSSM feeding. TSSM produce webbing on leaves.

#### Leafrollers: Obliquebanded Leafroller (OBLR) and Orange Tortrix (OT) **Pheromone Traps**

- •Place OT pheromone traps out in late March and OBLR traps in mid-May to determine infestation from second generation caterpillars, which can be a harvest contaminant during (July – early August)
- •Place one or two traps in each field, hang from top trellis wire approximately ten feet from the windward edge of the field. Replace lure as suggested by manufacturer.
- •Check traps regularly by removing, counting, and recording the number of moths
- •OBLR: 10 days after peak adult catch, begin monitoring for larvae in shoot tips
- •OT: adults, eggs, and larvae may all be present at the same time. Use traps to determine peak adult flight and general population data.

#### **OBLR larva and adult**











#### **Monitoring Larvae**

- •Examine a maximum of 5 shoot tips per hill for presence of caterpillars
- •Record number of infested hills for each site
- •If 10% or more hills are infested, a spray may be advisable to control overwintering spring generation before bloom
- •Larvae can also be detected using the beating tray sampling method

#### Yellow Spider Mite and Damage Two-Spotted Spider Mite and Damage









#### **Yellow Rust**

- •Starting in late April, examine the oldest leaves on developing laterals near the wire for infection
- •Rate infection level on a scale of 0-3
- •Watch closely to determine when these pustules begin to sporulate
- •Fungicides can be applied to protect new foliage as sporulation begins











#### **General Guidelines for Scouting in Raspberry Fields**

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#### **Beating Tray Sampling Method:**

Use beating tray to *survey the canopy* for several insect pests that can directly damage fruit or may pose problems as harvest contaminants as well as for beneficial insects. At each site, take ten tray *samples and record* the total number of each pest and beneficial insect dislodged from foliage. Hold tray one foot below trellis wire within canopy and shake foliage by grasping wire and shaking, or striking top wire three times with rubber sprayer hose to dislodge insects. Alternate samples between rows and check about every ten feet down the row.

#### **Black Vine Weevils**

- •Expect to start seeing adult BVW in beating tray samples in late May with numbers increasing into June
- •Record # and type of weevils from beating tray
- •If there is no feeding damage or weevils in beating trays, a treatment may not be necessary



#### **Spider Mites**

- •Spider mites can begin to increase at this time of year
- •Collect ten leaflets per site
- •Examine leaves using a 10X hand lens for presence of mites, eggs, and mite predators
- •Count the number of spider mites and mite predators and record information at each site
- Factors influencing thresholds include spider mite density, abundance of predators, population trends, damage to foliage, weather conditions, and miticide per-harvest interval



#### Voles

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





#### Western Raspberry Fruitworm or Raspberry Beetle

- •Record the number of adults from beating tray samples
- •Pay attention to interveinal feeding damage to leaves
- •Monitor adult flight activity with white sticky traps, such as the Rebell Bianco®. Locate traps along field edges.
- •Check traps weekly and record # of beetles per trap
- •Consider treatment prior to introducing bees if:
  - Average beetles per trap are above 2 for IQF and above 5 for other processed fruit
  - Or adults are detected at most sites
- Decision varies with processing type





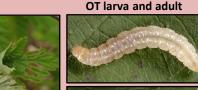
#### Leafrollers: Obliquebanded (OBLR) and Orange Tortrix (OT) Pheromone Traps

- •Place OT pheromone traps out in late March and OBLR traps out in mid-May to determine the infestation from second generation caterpillars, which can be a harvest contaminant during July and early-August. Adults usually start flying in late May.
- •Place one or two traps in each field, hang from top trellis wire approximately ten feet from the windward edge of the field
- Check traps regularly by removing, counting, and recording the number of moths
- •OBLR: 10 days after peak adult catch, begin monitoring for larvae in shoot tips
- •OT: adults, eggs, and larvae may all be present at the same time. Use traps to determine peak adult flight and general population data.

#### **OBLR larva and adult**









#### **Monitoring Larvae**

- •Examine a maximum of 5 shoot tips per hill for presence of caterpillars
- •Record number of infested hills for each site that you sample
- •Larvae can also be detected using the beating tray sampling method. Record # and approximate size of leafrollers found in beating tray.
- •Treatment threshold is 10% or more of infested hills

#### Spur Blight (Cane Disease)

- •Check foliage for brown wedge-shaped lesions
- •Examine lower primocanes for dark brown area around bud
- •Record severity on a scale of 0-3

#### Management:

- Consider field disease history. Wet weather during harvest increases likelihood of continued infection of new canes.
- •Cultural practices can impact incidence of spur blight. To reduce disease pressure, consider:
  - Keeping weeds controlled around plants
  - Reducing the number of primocanes
  - Remove and destroy old fruiting canes after harvest.
  - Avoid overhead irrigation
- Fields with a history of spur blight should be treated with a fungicide in early bloom
- Most fungicides that control *Botryits* will also help to control spur blight

#### **Botrytis Fruit rot and Cane Botrytis**

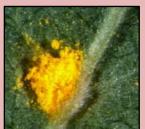
- Initial infection of fruit begins during early bloom when spores are dispersed by wind and splashing water
- No monitoring program exists at this stage
- •A protectant fungicide is usually necessary in the 10% bloom stage, usually followed by a second application 14 days later
- Subsequent applications depend on incidence of fruit infection, method of irrigation, and weather conditions
- •Cultural practices can impact incidence of botrytis. To reduce disease pressure, consider:
  - Using drip irrigation and avoid over-irrigating
  - Avoid high cane density which can increase RH



#### **Yellow Rust**

- •Examine the oldest leaves on developing laterals near the wire for infection.
- •Watch closely to determine when these pustules begin to sporulate
- •Rate infection level on a scale of 0-3 for both aecia and uridia (sporulating) stages
- •A fungicide may be necessary to protect new growth if disease is found at most sites in a field and wet weather persists
- •Fungicides can be applied to protect new foliage as sporulation begins







Yellow rust aecia

Yellow rust uridia





### **Pre-Harvest**

June

#### **General Guidelines for Scouting in Raspberry 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.

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#### **Harvest Contaminants**

- •Continue beating tray samples to monitor weevils and miscellaneous cutworms
- •The best time to use a beating tray is early in the morning before weevils move down from the canopy, or on cool cloudy days

#### Weevils

- Black Vine weevil counts increase in mid to late June
- Rough Strawberry weevil is found foraging canopy foliage at night; adults are found by sifting soil around crown during day. At each location, inspect debris at base of plants for adults.
- •Most of the feeding damage from BVW is in the center of the canopy around the wire
- Take extra samples near field borders, particularly if there is a woodlot, older strawberry field, or rhododendron planting at the border
- Record # of weevils collected per site from beating tray
- A treatment may be needed if a few weevils are found at each site. If there is no feeding damage and weevils are not detected using beating trays, a specific weevil spray may not be necessary.









#### **Climbing Cutworm**

- Pay close attention to miscellaneous cutworm larvae in beating tray at this time
- A few small worms occasionally detected in a field may indicate a major hatch coming



### Leafrollers: Obliquebanded (OBLR) and Orange Tortrix (OT) Pheromone Traps

- •Check traps regularly by removing, counting, and recording the number moths
- •At about 10 days after peak trap catch, it is time to monitor OBLR caterpillars in the field. For OT, all stages are present at all times; use traps to determine peak adult flight and general population sizes.

#### **OBLR** larva and adult





#### OT larva and adult





#### **Monitoring Larvae**

- •Examine a maximum of 5 shoot tips per hill for caterpillar presence
- •Record number of infested hills for each site that you sample
- •Larvae can also be detected using the beating tray sampling method. Record # of leafrollers found on beating tray.

#### **Botrytis** Fruit rot and Cane **Botrytis**

- Green berry infections can be identified as purplish-grey hard berries
- Monitor for ripening fruit as grey fuzzy mold on fruit
- Depending on weather conditions, a third and fourth fungicide application may be necessary
- •Treatment frequency depends on processing type
- •Cultural practices can impact incidence of botrytis. To reduce disease pressure, consider:
- Using drip irrigation and avoid over-irrigating
- Avoid high cane density which can increase RH





### •Watch closely to determine when these cessing type pustules begin to sporulate; fungicides can be applied to protect new foliage as sporulation

begins
•Rate infection level on a scale of 0-3 for both aecia and uridia (sporulating) stages

Examine the oldest leaves on developing

laterals near the wire for infection

 A fungicide may be necessary to protect new growth, if disease is found at most sites in a field and wet weather persists





Yellow rust uridia



Yellow rust aecia



#### **Spotted Wing Drosophila**

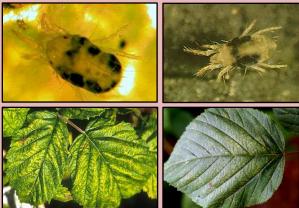
- •Male SWD flies have a small dark spot on the front edge near the tip of each forewing
- •Set-up 16oz plastic cup traps containing about ½ inch apple cider vinegar. Place traps in the field. Monitor traps at least once per week, twice per week when fruit is ripening and look for adults in the traps.
- •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

#### **Spider Mites**

- •Spider mites can increase quickly at this time of year
- •Collect ten leaflets per site
- Examine leaves using a 10X hand lens for presence of mites, eggs, and mite predators
- •Count the number of spider mites and mite predators at each site

**Yellow Rust** 

- •Trends are important when determining if a treatment is necessary
- •A spider mite spray may be necessary before harvest :
  - IF spider mites are approaching 10/leaflet or more and there are few or no predators
  - IF spider mites are increasing and there are numerous eggs
  - IF spider mites are increasing and the predator: prey ratio is less than 1:10
  - IF miticide PHI is 3 or more days and the population is building







# Harvest July – Early August

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#### **Harvest Contaminants**

- •Harvesting machines are one of the best insect monitoring tools
- •Ride the harvester to see what insect contaminants are coming across the belt. This is one of the best ways to evaluate the effectiveness of a preharvest clean up spray
- Train harvest workers on harvesting machines to communicate presence of harvest contaminants
- •Keep a container for workers to deposit contaminants
- •Many insects can be removed from the sorting belt by hand
- •Continue to use beating trays every two weeks to assist with harvester observations
- •Check pre-harvest intervals closely on any pesticides used during harvest period



#### Leafrollers: Obliquebanded (OBLR) and Orange Tortrix (OT)

- Check traps weekly by removing, counting and recording # of OBLR and OT moths
- •If flight is delayed until just prior to or after harvest, inspect hills for leafrollers
- •Look for worms in new growth. Record # infested hills.
- •Treatment threshold is 10% or more infested hills or thresholds vary according to end usage and processor
- Bacillus thuringiensis (B.t.) is effective if timed properly and has a short PHI

#### Weevils

- Detection of weevils on the belt indicates that either sprays were not effective or adult weevils are continuing to emerge
- A spray should be applied to control adult weevils if they are contaminating fruit so they can be controlled before egg-laying



#### **Armyworms and Cutworms**

•If too numerous to be removed from the sorting belt, treatment may be necessary for cutworms and leafrollers. This is most common at the end of the harvest period.





#### Raspberry Beetle / Raspberry Fruitworm

- •Most will be in larval stage at this time
- •Examine fruit for feeding damage in the field or on harvesting belt to determine if pest will be a problem in following year
- •Tolerances depend on processing type
- Management should be done when adult is present, at around 5% bloom; not at this time







#### **Spider Mites**

- •Two-spotted is most common; yellow spider mites also found
- Mite populations can increase rapidly during harvest; check fields ever 10-14 days
- Examine 10 leaflets at each site using a 10X hand lens beginning early May
- Record # spider mites and mite predators found
- Look for bronzing damage to leaves
- •Thresholds vary depending on plant vigor. An increasing mite population with many eggs and few predators may require treatment.
- •Treatment timing depends on pre-harvest interval of available miticides

#### **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 ½" apple cider vinegar. Place traps in the field. Monitor traps at least once per week, twice per 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





#### Spur Blight (Cane Disease)

- Examine leaves for irregular-shaped brown lesions with yellow margins on fruiting lateral leaves and brown wedge shaped lesions on lower primocane leaves
- Examine lower primocanes for dark brown area around bud
- •Record level of damage on a scale of 0-3

#### Management:

- •Cultural practices can influence disease pressure:
  - Keep weeds controlled around plants
  - Remove and destroy old fruiting canes after harvest
  - Avoid overhead irrigation
- Consider field disease history. Wet weather during harvest increases likelihood of continued infection of new canes.

#### **Phytophthora** Root Rot

- •Target yellow plants with sudden wilting
- Pull samples as soon as symptoms are seen and send for PCR (including ELISA) tests
- No thresholds are established; field history, age of planting, size of affected area, and results of pathogen testing should be considered
- Cultural practices can impact incidence of root rot.
   To reduce disease pressure, consider:
  - •Use higher raised beds
  - Reduce compaction in these areas of the field
  - Avoid over irrigating
- •Fall or spring applied fungicides can be used



#### **Botrytis Fruit rot and Cane Botrytis**

- Examine fruit for grey mold and canes for pale brown lesions (much lighter color than spur blight)
- Record level of fruit and cane infection on a scale of 0-3
- Presence of diseased fruit may indicate need for fungicides during harvest period
- Interval between fungicide applications may be lengthened if weather is dry
- Avoid overhead irrigation; avoid excessive canopy; avoid excessive nitrogen fertilization; pick fruit frequently as it ripens







#### **Cane Blight (Cane Disease)**

- Harvest is key time to reduce cane injury which may increase cane blight incidence
  - Adjust catcher plates on harvesters if they are causing damage
  - •Train harvester drivers to drive in a straight line
- Examine primocanes for evidence of damage from catcher plates
- •Record % of hills infected
- •Current season infection cannot be seen until late fall
- •Consider field history when making management decisions. If 1-3% of fruiting canes are infected, consider treatment.





### **Post-Harvest**

August - September

#### **General Guidelines for Scouting in Raspberry Fields**

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#### **Spider Mites**

- Populations can increase rapidly in August
- Examine 10 leaflets at each site using a 10X hand lens beginning early May. Record # spider mites and mite predators found.
- Predators can become quite numerous late in the season. If predator to pest mite populations are 1:10 or higher, predators should keep spider mites in check.
- Treatment considered unnecessary unless populations reach 25 mites per leaflet by September 1.







#### **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 field is strongly discouraged.
- Adults are attracted to dropped fruit and will feed on it





#### **Plant Parasitic Nematodes**

- Microscopic wormlike organisms feed on and damage roots
- Affected plants may appear stunted and fall root samples may exhibit a loss of fine feeder roots
- •In September, soil and root samples from good vs. poor areas in a field should be sent to a laboratory and analyzed for population size and makeup
- Each sample should represent approximately 10 plants scattered throughout sample area
- •Using a shovel and pruners, collect soil and feeder roots from top foot of each plant sampled
- •Thresholds are variable, See Raspberry IPM Manual http://whatcom.wsu.edu/ipm/manual/rasp





#### **Raspberry Crown Borer**

- •Adult, egg, and caterpillar stages may be present at this time
- •Check lower canes and crowns for presence of
- Pay particular attention to weak areas in the field which have smaller, spindly canes or canes that break at the base when tying up to the wire in the winter and spring. Train pruning crew to report suspect canes and their locations.
- •No threshold is established. If plants are found with hollow canes caused by borer feeding, consider chemical treatment during October.
- •If damage is present, treat for 2 consecutive years to obtain control







#### **Cane Blight (Cane Disease)**

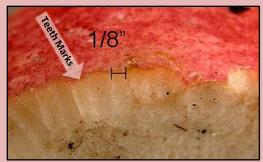
- Examine primocanes for evidence of damage from catcher plates
- Scrape away epidermis at catcher plate height and look for brown stripe lesion
- Record % of hills infected
- •Lower cane density creates decreased disease pressure. Train pruning crew to choose appropriate cane numbers per hill.
- Consider history of infection for treatment decision; if 1-3% of fruiting canes are infected, consider treatment the following season.



#### **Phytophthora** Root Rot

- •Target yellow plants with sudden wilting
- Identify areas with symptoms
- Pull samples as soon as symptoms are seen and send for PCR (including ELISA) tests
- No thresholds are established; field history, age of planting, size of affected area, and results of pathogen testing should be considered
- Cultivate so that water drains away from plants into center of alley
- Fall and/or Spring applied fungicides can be used
- Avoid planting raspberries in fields with history of Phytophthora. Avoid planting infected plants.







#### Spur Blight (Cane Disease)

- Examine leaves for irregular-shaped brown lesions with yellow margins on fruiting lateral leaves and brown wedge shaped lesions on lower primocane leaves
- •Examine lower primocanes for dark brown area around bud
- •Record % of hills infected
- •Cultural practices can influence disease pressure:
  - Keep weeds controlled around plants
  - Remove and destroy old fruiting canes after harvest
- Consider field disease history. Consider treatment in following year if 10% of hills are infected.

#### 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/manual/rasp





### **Raspberry**

### **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 kill beneficial insects. Scout for natural enemies as well as pests to understand relationships between the two in a field; often 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.

#### Predatory Mites (Amblyseius fallacis):

- •This naturally occurring predator mite feeds on spider mites.
- Only visible using 10X hand lens
- •Predatory mites are much faster moving than plant-feeding mites
- •Rates of 1 predatory mite: 10 spider mites has been shown to give good control

### Spider Mite Destroyer (Stethorus punctillum)

- •Adult is a small lady beetle (1/10 inch long) and a very effective spider mite predator
- •Larvae are 1/2 inch long







#### **Minute Pirate Bug:**

- •This small adult bug (1/16 inch long) feeds on spider mites, aphids, and thrips
- •Minute pirate bug nymph stage (4<sup>th</sup> instar). Front part of body is usually more orange than appears here.





#### **Lady Beetles**

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







#### Lacewing

- \*Adult lacewings are  $\frac{1}{2}$  to  $\frac{3}{4}$  inches 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  $\frac{1}{2}$  inch long when mature and resemble mini-alligators. They feed on aphids, spider mites, and immature plant bugs.









#### **Ground Beetle**

- •Adults are about % inch long. They feed at night on a variety of insect pests including cutworms and adult weevils.
- •These require shelter in a grassy bank or similar refuge

#### **Stink Bug**

- •Adults are about ½ inch long. Here it is feeding on a small looper.
- •Note the extended, beak mouthpart at work



#### Damsel Bug

- •Adult damsel bug. Slender body about ½ inch long.
- •Note the beak-like mouthpart and enlarged front legs for grasping prey

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#### **Syrphid Fly**

- Adult syrphid fly is about ½ inch long. They fly quickly, hover over plants, and feed on pollen, nectar or honeydew.
- •Larvae are about ½ inch long, usually brown or green with body narrowing toward the head. They feed on aphids.





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.

Scouting equipment should include:

- Magnifying Hand Lens (10X power)
- Scouting Report Forms
- Traps for Key Pests
- Digital Camera
- Beating Tray

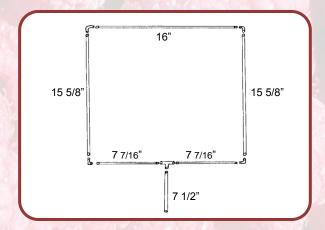
A beating tray is an 16 X 16 inch canvas or cloth covered tray and is very useful for sampling numerous beneficial and pest insects which reside in the canopy. One such tray has a frame and handle built of ½ inch PVC pipe and a black and white sided cover made of a material called "Sunbrella." Similar trays can be constructed with other locally available materials as well.

To use the beating tray: hold tray one foot below trellis wire within canopy and shake foliage by grasping wire and shaking, or striking top wire three times with rubber sprayer hose to dislodge insects.

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 Raspberry IPM in Northwest Washington, see the Raspberry IPM Manual online at: http://whatcom.wsu.edu/ipm/manual/rasp

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