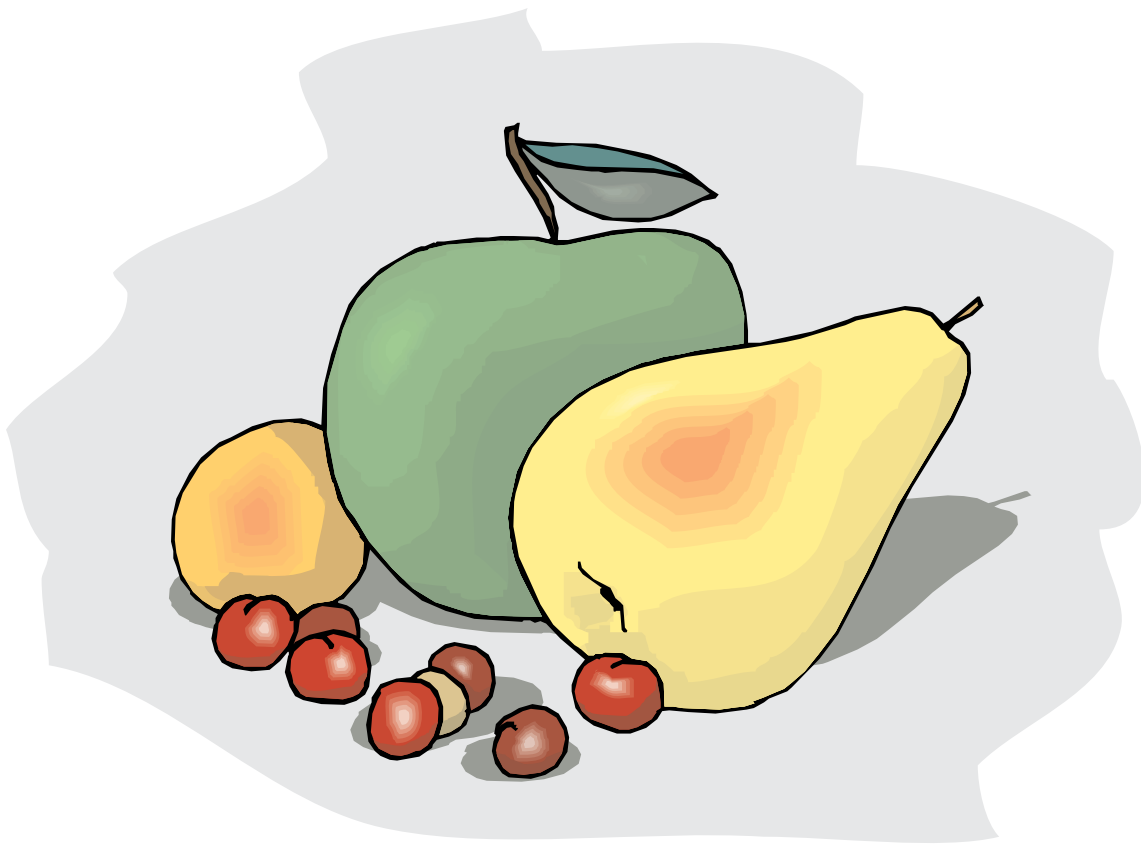


2008 Pest Management Guide

FOR TREE FRUITS IN THE MID-COLUMBIA AREA

Hood River • The Dalles • White Salmon

EM 8203-E • Revised January 2008



CAUTION!
Pesticides must be used as directed
on the label. Read and follow the
label when applying pesticides.

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This publication is available as a PDF file at <http://extension.oregonstate.edu/catalog/pdf/em/em8203-e.pdf>

For information on pest management in peaches, see the 2008 Peach Pest Management Guide for Oregon at <http://extension.oregonstate.edu/catalog/html/em/em8419-e/>

For more information, including information on bioregulator sprays, see the 2008 Crop Protection Guide for Tree Fruits in Washington at <http://cru.cahe.wsu.edu/CEPublications/eb0419/eb0419.pdf>

Using Pesticides Safely

Ronda E. Hirnyck

Revised November 30, 2007

Always Read the Label

The single most important approach to pesticide safety is to read the pesticide label before each use and then follow the directions. If still in doubt after reading the label, contact a person qualified to help evaluate the hazard of the chemical and its use. Qualified people include appropriate Extension specialists and county educators and product representatives.

Pesticides are toxic and should be handled with care—but pesticides can be used safely if you follow recommended precautions. Follow all label requirements; strongly consider any recommendations for additional personal protective clothing and equipment. In addition to reading and following the label, other major factors in the safe and effective use of pesticides are the pesticide applicator's common sense, qualifications, and good attitude. Always take all safety precautions when using pesticides.

In case of accidents involving pesticides, see your doctor at once. It will help your doctor greatly to know exactly which pesticide is involved. The label on the container gives this information. Take to the physician the pesticide label or information from the label—the product name, registration number of the U.S. Environmental Protection Agency (EPA), common name and percentage of active ingredient, and first aid instructions. If the label cannot be removed, take along the pesticide container (if not contaminated), but do not take it into the hospital or doctor's office.

Safety Checklist

- ✓ If you plan to apply any of the more dangerous pesticides, make sure your physician knows the types of compounds you are using.
- ✓ Follow all requirements for personal protective clothing and equipment (PPE) listed on the pesticide label. Bathe and change clothing daily. Separately launder clothing used during pesticide application or handling.
- ✓ Wear a respirator when loading or mixing concentrates and whenever pesticides might be inhaled.
- ✓ Do not smoke or chew tobacco or eat while handling pesticides. Wash hands before eating, smoking, and using the bathroom.
- ✓ Do not eat unwashed, chemically treated fruit or vegetables in the field. Time limits from application to harvest (preharvest intervals, or PHI) are to protect the consumer from harmful residues. Disregarding these limits presents a special hazard to the picker, grower, and field person.
- ✓ Recycle or dispose of pesticide containers properly, as described later in this section.
- ✓ Keep your pesticide storage shed or room locked.
- ✓ Mix pesticides according to directions and apply them precisely at the recommended rate.
- ✓ Poisoning occurs most often in hot weather, when applicators might not be wearing all the personal protective equipment (PPE) the label requires. Using PPE is a label requirement. However, take extra care when wearing PPE during hot weather to avoid heat-related illnesses.

What to Do in Case of Pesticide Poisoning

Follow the specific first-aid instructions on the pesticide label.

Get medical advice quickly, by calling your Poison Center (toll free) at 1-800-222-1222 or by calling a physician if you or a fellow worker has unusual or unexplained symptoms starting at work or later the same day. Do not let yourself or anyone else get dangerously sick before calling a physician or going to a hospital. It is better to be overly cautious than to delay or be too lax. Take the pesticide label (or information from the label—the product name, EPA registration number, common name and percentage of active ingredient, and first aid instructions) to the physician. If the label cannot be removed, take along the pesticide container (if not contaminated), but do not take it into the hospital or doctor's office.

If labeling instructions are not available, follow these general guidelines for first aid.

1. **The best first aid in pesticide emergencies is to remove the source of pesticide exposure as quickly as possible.** By removing the victim from the source, you not only protect him or her from further poisoning but you also protect yourself while you administer first aid.
2. First aid is the initial effort to help a victim while medical help is on the way. If you are alone with the victim, make sure the victim is breathing and is not being further exposed to the pesticide before you call for emergency help. Apply artificial respiration if the victim is not breathing. **Do not become exposed to the pesticide yourself while you are trying to help.**
3. **Pesticide on skin**—Drench contaminated exposed skin with plenty of water. Remove personal protective equipment and contaminated clothing. Wash skin and hair with a mild detergent and water. Dry victim and keep him or her comfortable.
4. **Pesticide in eye**—Wash the eye quickly but gently with clean running water. Rinse eye for 15 minutes or more.
5. **Inhaled pesticide**—Get the victim to fresh air immediately. Loosen tight clothing on the victim that would constrict breathing. Apply artificial respiration if the victim is not breathing or has bluish skin. If pesticide or vomit is on the victim's mouth or face, avoid direct contact and use a shaped airway tube, if available, for mouth-to-mouth resuscitation.
6. **Pesticide in mouth or swallowed**—Rinse mouth with plenty of water. Do not induce vomiting or give high-potency activated charcoal unless a physician or the label tells you to do so.
7. **Induce vomiting only if the label indicates.** Position the victim face down or kneeling forward and carefully put a finger or the blunt end of a spoon at the back of the victim's throat.
8. Do not induce vomiting if the victim is unconscious or convulsing, or if the victim has swallowed a corrosive poison or an emulsifiable concentrate or oil solution.
9. **Atropine should be administered only by a physician.** It can be poisonous if misused and can mask the symptoms of poisoning, thus delaying proper treatment.
10. **First-aid kit**—A properly equipped portable first-aid kit can be important in a pesticide emergency. Make sure one is available at each work site.

Pesticide Spills and Cleanup

Handling Spills

The best way to handle a spill is to prevent it from happening. Review your process for using, transporting, and storing pesticides to identify areas for additional training or precautions. Train workers to take the necessary actions if a spill should occur. Prior training on how to limit a spill and then safely clean it up is invaluable. Accidents most commonly happen when pesticides are being transported or when pesticide containers have leaked in storage.

Pesticide spills require immediate action. Keep a spill cleanup kit immediately available at all locations where pesticides are handled, transported, or stored, because you will not have time to locate all the necessary items before a significant amount of contamination has occurred. Important items in a typical spill kit include:

1. Telephone numbers for emergency assistance
2. Personal protective clothing and equipment as required by the label, including:
 - a. Sturdy gloves, footwear, and apron that are chemically resistant to most pesticides.
 - b. Protective eyewear
 - c. An appropriate respirator, if any of the pesticides requires using a respirator during handling or for spill cleanup
3. Containment "snakes" to confine the leak or spill to a small area
4. Absorbent materials such as spill pillows, absorbent clay, dry peat moss, sawdust, "kitty litter," activated charcoal, vermiculite, or paper to soak up liquid spills
5. Sweeping compound to keep dry spills from drifting or wafting during cleanup
6. A shovel, broom, and dustpan made from nonsparking and nonreactive material (foldable brooms and shovels are handy because they can be carried easily)
7. Heavy-duty detergent
8. Fire extinguisher rated for all types of fires
9. Any other spill cleanup items specified on the labeling of any products you use regularly
10. Sturdy plastic container that will hold the entire volume of the largest pesticide container being handled and that can be tightly closed
11. Highway flares (but don't use them around flammable material)

All these items can be stored in the sturdy plastic container and kept easily accessible, clean, and in working order until a spill occurs.

Response to a pesticide spill may vary with size and location of the spill.

You must know how to respond correctly to a spill. Stopping large leaks or spills is often not simple. If you cannot manage a spill by yourself, get help. Even a spill that appears to be minor can endanger you, other people, and the environment if not handled correctly. Never leave a spill unattended. When in doubt, get help.

The faster you can contain, absorb, and dispose of a spill, the less chance it will cause harm. Clean up spills immediately. Even minor dribbles or spills should be cleaned up as soon as possible to keep unprotected persons or animals from being exposed.

A good way to remember the steps for a spill emergency is the “three C’s”: Control, Contain, Clean up.

1. **Control the spill situation:** Protect yourself, stop the leak, protect others, and stay at the site.
2. **Contain the spill:** Confine the spill, protect water sources, absorb liquids, and cover dry materials.
3. **Clean up:** Clean up the spill, decontaminate the spill site, neutralize the spill site, decontaminate equipment, and decontaminate your PPE.

Reporting Spills

Report pesticide spills as well as pesticide-related fires and poisonings first to 9-1-1 for immediate response. Then report to the appropriate number below.

Idaho

Report all spills, fires, and poisonings to the EMS dispatcher: 800-632-8000 (in Idaho only).

Washington

Report all spills to the environment, fires, and poisonings to the Department of Emergency Management: 800-258-5990.

Report spills or discharges to containment areas to the nearest regional office of the Department of Ecology; find locations online at <http://www.ecy.wa.gov>

Oregon

Report spills to the Oregon Emergency Response System:

800-452-0311 (in Oregon)
503-378-6377 (Salem area)

Additional help with chemical emergencies, including pesticide emergencies involving spills, leaks, fires, or exposures, can be obtained from the Chemical Transportation Emergency Center:

CHEMTREC, 800-424-9300

Cleaning, Recycling, and Disposing of Agricultural Pesticide Containers

Unrinsed or contaminated empty pesticide containers are considered hazardous waste, unless a pesticide distributor or manufacturer will accept them for refilling. Hazardous waste is more difficult and more expensive to dispose of than solid waste.

Clean, dry containers are considered solid waste and can be disposed of in a state-permitted solid waste site. Clean, dry containers also may be recycled. Only dry, properly rinsed containers are accepted at collection sites, so thoroughly rinse all residues from the containers immediately after use. Properly rinsing and handling empty pesticide containers is very important, because it:

- Protects humans by removing hazardous materials
- Prevents sources of environmental contamination
- Saves money by putting all product into the spray tank

How to Properly Clean Pesticide Containers

Two websites have helpful container-rinsing information:

- Northwest Ag Plastics, Inc.
<http://www.nwagplastics.com/preparation.php>
- Ag Container Recycling Council
<http://www.acrecycle.org/rinsing.html>

Think Safety!

Unrinsed pesticide containers still can hold enough material to harm people and the environment. The person cleaning the containers should observe these precautions:

- Read and understand all safety and environmental precautions on the pesticide label.
- Wear eye protection such as goggles or a face shield.
- Wear chemical-resistant gloves that will neither absorb pesticide or rinse water nor let the material contact the skin.
- Wear chemical-resistant apron, gloves, and footwear or chemical-resistant covers over shoes or boots.

The best way to dispose of rinsate is to add it in the spray mixture and apply it according to the label directions. Rinsate also can be collected for later use in a spray mix or for disposal. Do not mix different pesticide rinsates. Label each storage container clearly. Do not dump rinsate on the ground or into storm drains.

Triple/Multiple Rinsing

Plastic and Metal Containers (jugs)

- Empty the container's contents into spray tank, turning the container so that any product trapped in the handle can flow out. Once flow is down to a drip, drain the container an additional 30 sec.
- Immediately begin rinsing. Do not wait, or the product may become difficult to remove.
- Fill the empty container one-quarter full of clean water.
- Replace the cap on the container. With the container opening facing to your left, shake the container about 6 inches left to right. Shake the container about twice per second for 30 sec.
- Drain rinse water into spray tank as described above.
- Fill the empty container one-quarter full of clean water a second time.
- Recap the container. With the opening of the container pointed toward the ground, shake the container about 6 inches up and down. Then drain the rinse water into the spray tank.
- Finally, fill the empty container one-quarter full once more with clean water. Recap the container. With the container in the normal upright position, shake the container about 6 inches up and down. Pour the rinse water into the spray tank.
- Carefully rinse residue from the outside of the container into the spray tank.
- Carefully rinse cap over spray tank opening.
- Look closely at the container inside and out to make sure that all pesticide has been removed.
- Note that Oregon law requires rinsing the containers as many times as is necessary with an appropriate diluent (solvent) to get the container clean.
- Allow the containers to dry.
- Oregon requires that 1- and 5-gal metal containers be punctured at least three times with 1-inch holes and then crushed.
- Store cleaned jugs and caps where they will be protected from rain until they can be recycled or disposed of properly.

Drums

- Empty drum as much as possible.
- Fill drum one-quarter full with water. Replace and tighten bungs.
- Tip drum on its side and roll it back and forth, ensuring at least one complete revolution, for 30 sec.
- Stand the drum on its end and tip it back and forth several times to rinse the corners.
- Turn the drum over on its other end and repeat this procedure.
- Carefully empty the rinsate into the spray tank.
- Repeat this procedure until the rinse water runs clear.
- Carefully rinse cap over spray tank opening and then dispose of appropriately as regular solid waste.
- Look closely at the containers inside and out to make sure all pesticide has been removed.
- Note that Oregon law requires a person cleaning pesticide containers to rinse the containers as many times as is necessary with an appropriate diluent (solvent) to get the container clean.
- Puncture the base of the drum with a drill so that it cannot be reused.
- Allow drums to dry.
- Oregon requires that the tops and bottoms of 30- and 55-gal containers be removed and the container flattened after it has dried.
- Store drums where they will be protected from rain until they can be recycled or disposed of properly.

Pressure Rinsing

This method continuously washes the inside of the container and drains into the spray tank. A pressure nozzle punctures and rinses the container in one step. It is easier and more effective than triple/multiple rinsing.

Containers (jugs)

- Empty contents of container into spray tank, turning the container so that any product trapped in the handle can flow out. Once flow is down to a drip, drain the container an additional 30 seconds.
- Immediately begin rinsing. Do not wait, or the product may become difficult to remove.
- Hold the container so the opening can drain into spray tank.
- Force the tip of the pressure nozzle through the lower portion of the side closest to the handle.

- Connect nozzle to a clean water source of at least 40 psi. Rotate the nozzle inside the container to assure good coverage of all sides, including the handle.
- Rinse at least 30 sec.
- Rinse cap under water coming out of the jug and into the spray tank and then dispose of cap appropriately as regular solid waste.
- Drain all rinse water into the spray tank.
- Look closely at the containers inside and out to make sure that all pesticide has been removed.
- Allow containers to dry.
- Oregon requires that an appropriate solvent be used for rinsing and that 1- and 5-gal metal containers be punctured at least three times with 1-inch holes and then crushed.
- Store cleaned jugs and caps where they will be protected from rain until they can be recycled or disposed of properly

Drums

- Be sure drum is completely empty.
- Drill a pilot hole in the bottom of the drum and then position the drum mouth over the spray tank so that rinse water will empty directly into the tank.
- With the water turned off, use the pressure rinse nozzle to widen the hole in the bottom.
- Turn water on and rotate the nozzle inside the drum so as to rinse all sides.
- Rinse drum at least 30 seconds or until rinse water runs completely clear.
- Rinse cap under water coming out of the drum and into the spray can and then dispose of appropriately as regular solid waste.
- Turn water off and replace the tip guard on the nozzle.
- Look closely at the containers inside and out to make sure all pesticide has been removed.
- Allow containers to dry.
- Oregon requires an appropriate solvent be used for rinsing and that the tops and bottoms of 30- and 55-gal drums be removed and the container flattened after it has dried.
- Store drums where they will be protected from rain until they can be recycled or disposed of properly.

Cleaning Paper or Plastic Sacks and Fiber Containers

- Empty the contents completely into the application equipment. You may need to cut open the container to clean out all the material in the seams. Never rip the container; use scissors or a knife but not a personal pocketknife. Do not let material blow around.
- Wear appropriate personal protective equipment, including breathing protection if necessary.
- If possible, rinse the container. Some containers have plastic or foil liners that can be rinsed. Use the rinsate in the spray mixture or collect it for disposal.
- Once the containers are clean, dispose of them as regular solid waste. Do not burn the containers. Burning can release poisonous fumes and is illegal.

Recycling Procedures for Plastic Containers¹

Disposal and Recycling

Proper disposal or recycling of pesticide containers helps to protect the environment and helps promote a positive image of agrichemical users. Recycling also saves money for the pesticide user and for local landfills.

Landfill Procedures

Landfills accept only containers that have been cleaned. Some landfills inspect containers and/or require written verification of their cleanliness. Disposal site locations are listed below.

Idaho, Oregon, and Washington have programs to collect and recycle clean plastic pesticide containers. The following steps will help in the recycling process. For times and places of recycling events, see the appropriate state contact listed below.

- Only clean, dry plastic containers can be accepted.
- Remove slip-on labels and label booklets. Glued labels may stay.
- Remove hard plastic lids and place them in a separate container for recycling.
- Remove most of the foil seal from around the opening to the container. A small amount of foil is acceptable.
- Remove lids and metal bails from 5-gal buckets. Lids from buckets are accepted if metal rings and rubber gaskets are removed. Containers of 5 gal and smaller are accepted whole.
- Do not put plastic lids back on empty containers. This inhibits container inspections.

¹ Container Preparation. Northwest Ag Plastics, Inc. <http://www.nwagplastics.com/>

Recycling and Disposal Contacts

Idaho

Recycling

Container Recycling Operation (CROP) 208-465-8442
<http://www.agri.state.id.us/Categories/Pesticides/container/indexcontainermain.php>

Disposal

Department of Environmental Quality state office
208-373-0502 <http://www.deq.state.id.us/>

Coeur d'Alene Regional Office 208-769-1422

Lewiston Regional Office 208-799-4370

Boise Regional Office 208-373-0550

Twin Falls Regional Office 208-736-2190

Pocatello Regional Office 208-236-6160

Idaho Falls Regional Office 208-528-2650

Oregon

Recycling

Oregon Agricultural Chemicals and Fertilizers Association 503-370-7024

Agri-Plas 503-390-2381 <http://www.recycle.net/trade/aa051028.html>

Disposal

Oregon Department of Environmental Quality
800-452-4011 (in Oregon) <http://www.deq.state.or.us/>

Bend 541-388-6146

Portland 503-229-5263

Salem 800-349-7677 (toll free in Oregon)

Medford 877-823-3216 ext. 227 (toll free in Oregon)

Washington

Recycling

Northwest Ag Plastics, Inc. 509-457-3850
<http://www.nwagplastics.com/>

Disposal

The State Department of Ecology has set minimum standards for handling solid wastes, but local health departments may be more restrictive.

Washington State Department of Ecology:
360-407-6000 <http://www.ecy.wa.gov/>

Northwest Regional Office (Bellevue) 425-649-7000

Southwest Regional Office (Lacey) 360-407-6300

Central Regional Office (Yakima) 509-575-2490

Eastern Regional Office (Spokane) 509-329-3400

Disposing of Household and Residential Pesticide Products

Unusable pesticide is regulated as a hazardous waste and needs to be disposed of according to RCRA regulations. Instructions for disposing of household and residential pesticides are changing. The EPA advises consumers to call local authorities for specific disposal instructions. This is to provide state and local governments greater latitude in carrying out their responsibilities for product disposal and waste management. Specific instructions will be provided for products based on formulation.

Labels on aerosol products will state: "Do Not Puncture or Incinerate! If empty: Place in trash or offer for recycling if available. If partly filled: Call your local solid waste agency or 800-CLEANUP (253-2687) or other qualified number for disposal instructions."

Labels on all other types of products will state: "If empty: Do not reuse this container. Place in trash or offer for recycling if available. If partly filled: Call your local solid waste agency or 800-CLEANUP (253-2687) or other qualified number for disposal instructions." This includes liquids, tablets, dusts, gels, pet products, etc., in other types of containers such as bags, bottles, bait stations, etc.

Labels no longer will say to wrap containers in newspaper before discarding in the trash. Also, labels no longer will instruct the consumer to rinse the container before discarding.

Idaho

The Idaho pesticide disposal program collects unusable household pesticides:

Vic Mason
Idaho Department of Agriculture
623 Eleventh Ave. South Nampa, ID 83651
Tel: 208-465-8442 Fax: 208-497-8311
E-mail: masonv@agri.state.id.us

Pesticides and Water Quality

Proper handling, use, and disposal of pesticides are critical for preventing adverse impacts on water resources. Environmental pollution can occur when pesticides enter surface and groundwater systems through misapplication, movement of treated soils, irrigation return flows, runoff from urban and agricultural land, storm water runoff, and leaching through soils. It is important to know the pesticide and soil

properties to help avoid water contamination. For additional information and links to publications on this topic, visit:

University of Idaho <http://www.uidaho.edu/wq/>
Oregon State University <http://water.oregonstate.edu/>
Washington State University <http://wawater.wsu.edu/>

Databases

- OSU Extension pesticide properties database, EM 8709. Available from Extension Soil Science: 541-737-5712
- OSU Extension soil sensitivity database, EM 8707. <http://extension.oregonstate.edu/catalog/html/em/em8707/>
- Oregon Water Quality Decision Aid (OWQDA). This aid uses both databases listed above to rate soil sensitivity, pesticide movement, and groundwater vulnerability, given the Oregon county name, the soil, and the pesticide. The OWQDA is available from OSU Extension Soils: 541-737-5712.
- An Overview of the Oregon Water Quality Decision Aid (OWQDA), EM 8705. 1998. <http://extension.oregonstate.edu/catalog/html/em/em8705/>

Pesticides, Endangered Species, and Mandatory No-spray Buffer Zones

Due to a recent court case, mandatory no-spray buffers have been established for some pesticides in some areas of Washington and Oregon. Buffers extend 60 ft by ground and 300 ft by air from affected water bodies. For a list of pesticides that require these buffers, as well as the Washington and Oregon lands affected, go to:

Washington http://agr.wa.gov/PestFert/EnvResources/Buffers.htm#COUNTY_MAPS

Oregon <http://egov.oregon.gov/ODA/PEST/buffers.shtml>

The EPA is reviewing pesticides for their effects on endangered species. The list of affected pesticides can change frequently; therefore, consult the list each time before applying pesticides in affected areas. The buffer restrictions at this point are not on the pesticide labels themselves; this does not change the requirement, however, to observe the buffer zone. Direct any questions to your state department of agriculture.

Special Pesticide Registration Options

Pesticides are federally registered by the U.S. Environmental Protection Agency (EPA) under Section 3 of the Federal Insecticide, Fungicide and Rodenticide

Act (FIFRA) as amended. This law also contains two provisions for states to obtain certain pesticide uses that are not available under federal registration, to address local pest-control problems:

- Emergency exemptions from registration under Section 18
- Special local needs registrations under Section 24(c)

Emergency Exemptions Under Section 18

Section 18 of FIFRA provides that the Administrator of EPA may exempt certain federal and state agencies from any provision of the Act if it is determined that emergency conditions exist. EPA has applied this section to exempt states from the provisions of FIFRA that regulate the manner in which a pesticide is made available for use or how it is used. An emergency exemption authorizes a state to permit use of a pesticide to control a pest problem, when the needed pesticide either is not federally registered or, if registered, it does not have residue tolerances established for the food/feed crops to be treated. Uses with existing residue tolerances can be registered under FIFRA Section 3 or 24(c).

EPA regulations for Section 18 provide four types of emergency exemptions: specific, public health, quarantine, and crisis.

Specific Exemptions

EPA may authorize specific exemptions for uses of pesticides when the emergency condition involves the need to control a pest to avert economic losses in crops or risks to beneficial organisms, endangered or threatened species, or to the environment. The state department of agriculture submits the formal request for a specific exemption, but the request must originate from or on behalf of the entities affected by the emergency. These entities should discuss the need for the exemption with knowledgeable consultants, appropriate university research or Extension personnel, the manufacturer of the pesticide, and the state department of agriculture, before initiating an exemption request. If a state department of agriculture is convinced that an emergency exists and has verified with EPA that the pesticide requested is a viable candidate for approval, it must submit an application to EPA that includes the following:

1. The nature, scope, and frequency of the pest problem
2. Currently registered pesticides and other available controls, and reasons why they cannot be used

3. The proposed program, including the material, dosage, area to be treated, etc., as well as precautions, limitations, and any potential hazards
4. Economic effects, including projected crop losses, both with and without the proposed exemption
5. Data to support the proposed use, including efficacy data, residue levels, and toxicological information

This information must be compiled by the requesting entity from sources such as consultants, commodity organizations, pesticide manufacturers, the USDA Interregional Research Project No. 4 (IR-4), and university personnel. The local state department of agriculture should be contacted for its guidelines on presenting and submitting the request.

EPA may approve or deny the specific exemption based upon biological, economic, environmental fate, and human health effects after reviewing the information submitted in the request. EPA also must assess dietary risks and establish special time-limited tolerances for residues of the pesticide if a food or feed crop is to be treated. The submittal and review process may range up to 3 or 4 months for a first-time request.

The duration of a specific exemption may not exceed 1 year, and a new request must be submitted for each additional use period. EPA may authorize the same exemption for several years, provided adequate progress is being made toward full registration.

The state department of agriculture may require the pesticide manufacturer to prepare special product labeling, which must include directions for use and restrictions and conditions of the approved specific exemption. The state also may require that the special label be in the user's possession at the time of application. Also, the state may require that materials to be used under an emergency exemption are applied using the best available pest control methods and technologies.

Crisis Exemptions

Under the crisis provisions of Section 18, a state may authorize use of a pesticide in emergency conditions, if the nature of the emergency is such that applications must be made before a specific exemption could be granted. Before a crisis exemption can be enacted, the state must notify EPA of its intent 24 to 36 hr in advance and receive verbal confirmation that EPA will be able to establish the required time-limited residue tolerance(s) prior to harvest, if food or feed crops are to be treated. If a specific exemption request for the

emergency use is not already under review at EPA, the state must submit such a request within 15 days of enacting the crisis exemption.

A state department of agriculture must provide essential details of the crisis exemption use pattern in a written notification to EPA, and must work closely with the manufacturer of the pesticide to ensure prompt product availability and proper use. The crisis exemption, when enacted, is handled in the same manner as a specific exemption.

Special Local Needs Registrations Under Section 24(c).

In each state, the department of agriculture is the designated lead agency responsible for registering pesticides to meet special local needs under section 24(c) of the FIFRA. A special local need (SLN) is defined as, "an existing or imminent pest problem within a State for which the State lead agency, based upon satisfactory supporting information, has determined that an appropriate federally registered pesticide is not sufficiently available."

Special Local Needs Registration

Under FIFRA Section 24(c), each state is authorized to register a new end use product for any use, or an additional use of a federally registered pesticide product, under the following conditions:

1. There is a special local need for the use within the state
2. The use is covered by necessary tolerances, exemptions or other clearances under the Federal Food, Drug and Cosmetic Act, if the use is a food or feed use
3. Registration for the same use has not previously been denied, disapproved, suspended or canceled by the EPA Administrator, or voluntarily canceled by the registrant subsequent to issuance by the Administrator of a notice of intent to cancel that registration, because of health or environmental concerns about an ingredient contained in the pesticide product, unless such denial, disapproval, suspension, or cancellation has been superseded by subsequent action of the Administrator
4. The registration is in accord with the purposes of FIFRA. Additionally, states can require specific criteria that need to be met before an SLN request will be considered. State department of agriculture offices will have more information on individual state criteria.

When a state grants an SLN registration, the EPA is informed and provided with a letter of notification and a copy of the accepted label. Once EPA receives state notification, EPA has 90 days in which to review the SLN for required pertinent information. The EPA may request modifications of the label or conditions of registration from a state, request data, disapprove the registration, or request the state to withdraw the registration. After 90 days, an SLN that has not been disapproved is considered federally registered but is authorized for distribution and use only within that state. EPA may disapprove the registration at any time if it believes that the use constitutes an imminent hazard or may result in excessive residue levels.

SLN registrations have been useful particularly to growers of minor crops, who often have limited access to pest management options, including pesticides.

Types of SLN registration requests considered include: adding a crop or site; incorporating an alternate application method, such as chemigation or dip (e.g., for bulbs); change application timing; encourage use of reduced-risk pesticides or pesticides that facilitate resistance management; or modify the application rate.

Additional Pesticide Information

Internet

Note This is not a complete listing of websites containing additional information on pesticide use and safety. The presence or absence of a given website below does not constitute an endorsement of one website over another.

Regulatory Authorities

The specific laws and regulations governing use, storage, disposal, and transportation of pesticides differ slightly in each northwest state. Before you use pesticides, obtain a copy of the detailed pesticide use laws and rules for the state(s) in which you are operating. The state-specific pesticide laws and rules can be found at each state department of agriculture website.

Idaho

For regulations on use and storage

Division of Agricultural Resources
Idaho Department of Agriculture
PO Box 790
Boise, ID 83701
Tel. 208-332-8500
<http://www.agri.state.id.us/Categories/Pesticides/indexPesticides.php>

Website Information	Website
Crop Data Management Systems (CDMS): a searchable database of print-on-demand pesticide labels including many SLN 24(c)	http://www.cdms.net/manuf/default.asp
A searchable database of Idaho Department of Agriculture registered pesticides	http://www.kellysolutions.com/id
NPIC—National Pesticide Information Center. a source of scientific, unbiased information	http://npic.orst.edu
Pesticide Information Center On-Line (PICOL) a searchable database of Washington and Oregon registered pesticides	http://cru66.cahe.wsu.edu/LabelTolerance.html
Pesticide toxicology information at EXTTOXNET	http://exttoxnet.orst.edu/
Northwest Coalition for Alternatives to Pesticides	http://www.pesticide.org/
A searchable database of Oregon Department of Agriculture registered pesticides	http://www.oda.state.or.us/dbs/search.lasso#pesticide
Idaho State Department of Agriculture	http://www.agri.state.id.us/
Washington State Department of Agriculture	http://agr.wa.gov/default.htm
Oregon State Department of Agriculture	http://egov.oregon.gov/ODA/

Disposal of Containers and Unwanted Pesticides

Idaho Department of Agriculture Container Recycling Program (CROP)

Tel. 208-465-8442

<http://www.agri.state.id.us/Categories/Pesticides/container/indexcontainermain.php>

Idaho Department of Agriculture Unusable Pesticide Disposal Program

<http://www.agri.state.id.us/Categories/Pesticides/pdp/indexdisposalmain.php>

or contact:

Vic Mason

Idaho Department of Agriculture

623 Eleventh Ave.

South Nampa, ID 83651

Tel. 208-465-8442

Fax 208-497-8311

Email masonv@agri.state.id.us

Idaho has one approved site where containers that once contained heavy metals or surplus pesticides may be discarded. Contact the owner or manager of the site:

American Ecology Corporation

300 E. Mallard Dr., Suite 300

Boise, ID 83706

Tel. 800-590-5220 (toll free)

Disposition of Waste on Owner's Land

Idaho Code Title 31, Chapter 44, contains regulations that apply to solid waste disposal on private land. A summary of these regulations states, "Every owner of land who disposes of solid waste on his own land shall obtain a written permit from the Board of County Commissioners for such disposal." The state attorney general's office stated that this was interpreted to include pesticide containers.

For regulations on hazardous waste

Department of Environmental Quality

1410 North Hilton

Boise, ID 83706-1255

Tel. 208-373-0502

<http://www.deq.state.id.us/>

Oregon

For regulations on use

Pesticides Division State Department of Agriculture
635 Capitol St. NE

Salem, OR 97301-2532

Tel. 503-986-4635

<http://egov.oregon.gov/ODA/PEST/index.shtml>

For regulations on disposal and collection

Oregon Department of Environmental Quality

Land Quality Division

811 SW Sixth Ave.

Portland, OR 97204-1390

Tel. 503-229-5696 / Toll free 800-452-4011

<http://www.deq.state.or.us/wmc/>

For more information on collecting and recycling decontaminated metal or plastic pesticide containers, contact:

Oregon Agricultural Chemicals and Fertilizers Association (OACFA)

1270 Chemeketa St. NE

Salem, OR 97301

Tel. 503-370-7024

Commercial Disposal

Oregon has only one commercial site for disposal of quantities of surplus or waste pesticides. It is operated by:

Chemical Waste Management of the Northwest, Inc.

18177 Cedar Springs Lane

Arlington, OR 97812-9709

Portland region office:

Tel. (toll free) 800-685-8001

Fax 800-583-5263

Email landfill@wmnorthwest.com

<http://www.wmnorthwest.com/landfill/contactus.html>

For information about commercial disposal, contact the company's Portland region office or any commercial hazardous waste contractor.

For regulations on storage

Office of the State Fire Marshall

4760 Portland Rd. NE

Salem, OR 97305-1760

Tel. 503-378-3473

<http://egov.oregon.gov/OSP/SFM>

For regulations on transportation

Oregon Department of Transportation
Motor Carrier Transportation Division
550 Capitol St. NE
Salem, OR 97301-2530
Tel. 503-378-5849
<http://egov.oregon.gov/ODOT/MCT/>

Washington

For regulations on use

Washington State Department of Agriculture
Pesticide Management Division
PO Box 42589
Olympia, WA 98504-2589
Tel. 360-902-2030 / toll-free: 877-301-4555
<http://agr.wa.gov/PestFert/Pesticides/>

For regulations on disposal

The State Department of Ecology has set minimum standards for handling solid wastes, but local health departments may be more restrictive.

Because a pesticide waste may be classified as a hazardous waste as well as a solid waste, the State Department of Ecology directs all questions concerning interpretation of the regulations and locations of disposal sites to its regional offices:

Washington State Department of Ecology:
360-407-6000
Northwest Regional Office (Bellevue) 425-649-7000
Southwest Regional Office (Lacey) 360-407-6300
Central Regional Office (Yakima) 509-575-2490
Eastern Regional Office (Spokane) 509-329-3400
<http://www.ecy.wa.gov/>

In some instances, it may be possible to detoxify hazardous wastes so that they may be disposed of in Washington. Consult with the Department of Ecology to determine whether this option is feasible.

Pesticide containers are considered “prohibited materials;” they cannot be burned outdoors if they release dense smoke, odors, or toxic emissions. Containers should be triple-rinsed; then they might be eligible for recycling programs or, as a last resort, disposed of as solid waste. For details, contact:

Washington State Department of Ecology
Hazardous Waste and Toxics Reduction Program
PO Box 47600
Olympia, WA 98504-7600
Tel. 360-407-6700
<http://www.ecy.wa.gov/programs/hwtr/index.html>

Worker Protection Standards (WPS) for Agricultural Pesticides

Key Features

The U.S. Environmental Protection Agency (EPA) in 1992 issued regulations pertaining to the Worker Protection Standard for Agricultural Pesticides (WPS). The WPS is designed to protect employees on farms, forests, nurseries, and greenhouses from occupational exposure to agricultural pesticides.

The EPA determined that previous regulations were inadequate to protect agricultural workers and pesticide handlers who are exposed occupationally to pesticides. The WPS is intended to reduce the risk of pesticide poisonings and injuries among agricultural workers and pesticide handlers through appropriate exposure-reduction measures.

The WPS contains requirements for notifying employees of applications, the use of personal protective equipment, and restrictions on entry to treated areas. Additionally, the WPS also requires certain actions by employers to ensure worker safety. The WPS requires the registrants of pesticides to add label references to the WPS and to list specific application restrictions and other requirements.

Affected Employees

WPS provisions are directed toward two types of employees.

Pesticide handlers—Those who mix, load, or apply agricultural pesticides; work with application equipment; assist in applying pesticides in any way; enter greenhouses or another enclosed area before inhalations exposure levels have been met; enter an outdoor area after application of any soil fumigant to adjust soil covering; or dispose of pesticides or their containers.

Agricultural workers—Those who do tasks related to the production of plants, including cultivating and harvesting the plants, on farms or in greenhouses, nurseries, or forests for any type of compensation.

Affected Employers

The WPS defines two types of employers affected by its provisions.

Agricultural employers—Those who employ or contract for the services of workers or own or operate an establishment that employs workers.

Handler employer—Those who hire pesticide handlers or are self-employed as handlers. This includes commercial and professional applicators.

Pesticide Products Covered by the WPS

The WPS covers nearly all pesticide products used to produce plants commercially, including pesticides used on soil and potting media. It also covers both restricted-use and general-use products. WPS provisions are intended to:

1. Minimize worker exposure to pesticides
2. Mitigate any exposures
3. Inform employees about the hazards of pesticides

Minimize Pesticide Exposure

Protection during applications—Handlers are prohibited from applying pesticide in a way that will expose workers or others. Workers must be kept out of areas while pesticides are being applied.

Restricted-entry Intervals (REIs)—Such intervals are specified on all agricultural pesticide product labels. Workers must be kept out of pesticide-treated areas during the REI with only a few exceptions. (See *Restricted-entry Intervals and Early-entry Work Situations for Workers and Handlers*, page 13.)

Personal Protective Equipment (PPE)—The employer is required to provide and maintain PPE for handlers and early-entry workers. The handlers and workers must be provided a place to remove, clean, and store PPE and to clean themselves. (See *Personal Protection Equipment (PPE) Definitions*, page 14.)

Notification of workers—Employers must notify workers about treated areas so that workers can avoid exposure. Information about recent applications must be posted in a central location at the workplace. Workers can be notified of applications orally or by posted signs. Oral warning must include the location and description of the area and the time during which entry is restricted, and must warn workers not to enter an area until the REI has passed. Signs must be posted at

all the entry points of treated fields, forests, or greenhouses. Signs must be posted 24 hours before the application, remain in place for the entire REI, and be removed within 3 days after the REI ends. At a minimum, signs must state that the area has been treated and people must stay out. The sign must be in English and in any other language the workers in the area understand. Signs must be 14 x 16 inches. Smaller signs (7 x 8 inches and 4.5 x 5 inches) may be used in greenhouses and nurseries. Contact your state's WPS contact, listed below, for more details.

Mitigate Pesticide Exposure

Decontamination—Employers must provide, for handlers and workers who handle anything that may have been treated with pesticides, a place to clean up after work. Sites for both types of employees must be within 0.25 mile of the work site but not in the work site. If the work site is not accessible within 0.25 mi by a vehicle, a decontamination station may be set up at the nearest access point. For handlers mixing pesticides, there must be a clean-up site at the mixing site. Sites must have enough potable water to wash eyes and the entire body in case of exposure. Sites also must have single-use towels, soap, and, for mixers, a pair of one-size-fits-all coveralls. Sites for handlers must be provided during the handling activity. Sites for workers must be provided for 30 days after the end of the REI.

Emergency assistance—Employers must make transportation available to take a worker injured by pesticides to an emergency medical facility. The employer must also provide the medical professionals with the label(s) of the product(s) used and the circumstances of the exposure.

Inform Employees about Pesticide Hazards

Pesticide safety training—Training, by a state-certified or other qualified trainer, must be given to all workers and handlers. Handlers and workers must be trained every 5 years. Early-entry workers (workers who enter an area before the restricted-entry period has ended) must be trained before they perform any early-entry work. (See *Educational Requirements under the Worker Protection Standard*, page 13.)

Pesticide safety poster—The WPS requires posting a pesticide safety poster in a central location. The poster must include tips on how to avoid pesticide contamination and a list of emergency phone numbers and

procedures. The poster should be kept in good condition.

Access to pesticide label information—The WPS requires that pesticide handlers and early-entry workers be informed of pesticide label safety information.

Access to specific information—Employers must post, in a central area accessible to all workers, specific information about pesticide treatments on that workplace. This information must be accessible to employees for at least 30 days after each pesticide application.

Penalties for Noncompliance

The WPS penalties for noncompliance are similar to penalties for using pesticides in a way that is inconsistent with the label. Fines are up to \$1,000 for private applicators and up to \$5,000 for commercial/professional applicators. Knowingly violating the WPS can result in fines up to \$1,000 and 30 days in jail for private applicators; for commercial applicators, fines can be as high as \$25,000 and 1 year in jail. Most states and tribes can enforce their own laws and regulations and have their own penalties. Contact state pesticide regulatory agencies for more details.

Educational Requirements under the Worker Protection Standard

A key part of the WPS is that those employed as either handlers or workers must receive training in order to reduce their risk of being harmed by pesticides. It is the employer's responsibility to make sure employees have received proper training. Training must be provided before anyone employed as a handler or an early-entry worker begins work. All other workers must be trained before they have worked 5 separate days in areas that have been treated within the past 30 days or in an area in which an REI has been in effect.

Training requirements are met with the following situations;

- The employee has been trained within the past 5 years, even if he or she has changed employers.
- The worker is currently certified as an applicator of restricted-use pesticides.
- The worker is currently trained as a handler who works under the supervision of a certified pesticide applicator.

Training can be given only by certain individuals, and it must be conducted in certain ways and cover certain topics. A person who trains handlers must:

- Be a currently certified applicator of restricted-use pesticides, or
- Be currently designated as a trainer of certified pesticide applicators or pesticide handlers by a state, federal, or tribal agency having jurisdiction, or
- Have completed a pesticide safety train-the-trainer program approved by a state, federal, or tribal agency having jurisdiction.

In order to train workers, the trainer must:

- Be currently qualified, as described above, to train handlers, or
- Be currently trained as a handler who works under the supervision of a certified pesticide applicator, or
- Be currently trained as a WPS handler, or
- Have completed a pesticide safety train-the-trainer program approved by a state, federal, or tribal agency having jurisdiction

A person must be trained at least once every 5 years, counting from the end of the month in which the previous training was completed, even if the person changes employers.

There are certain requirements for conducting training. The training must be in a language that trainees can understand and must use nontechnical terms. The training must use written and/or audiovisual materials. The trainer must respond to any trainee's questions.

For details on requirements and training materials, contact your state pesticide agency.

Restricted-entry Intervals and Early-entry Work Situations for Workers and Handlers

Restricted-entry Intervals

To minimize the potential for agricultural workers' exposure to pesticides, the Worker Protection Standard requires that pesticide products carry a Restricted-entry Interval (REI). REI is the time between the end of a pesticide application and the beginning of unlimited access to the treated area. During the REI, entry to the treated area is limited. The REI for a given product may be different for different crops, different climates, different crop activities (irrigation, pruning, etc.), or different application methods. When more than one pesticide product is applied, the longest REI is used. REIs for a pesticide product are on the pesticide label

under “Agricultural Use Requirements” in the “Directions for Use” section. Sometimes they might also be listed next to the crop or application method to which they pertain. It is very important to read the label before applying the pesticide.

REIs are based on the signal word assigned to a given pesticide product. Signal words are based on the toxicity of a pesticide product’s active ingredients. In general, REIs are:

Danger	48 hr
Warning	24 hr
Caution	12 hr

Exceptions to this general rule are common. REIs can be longer or shorter depending on the method or site of application, the toxicity of the specific active ingredients, and the way the active ingredients can affect human health. Certain insecticides that can also affect an enzyme in the human nervous system and that are applied outdoors in areas with less than 24 inches of rain a year have an REI of 72 hours. A few fungicides and soil-fumigants have REIs as long as 120 hours (5 days). Certain pesticides containing ingredients such as glyphosate, mineral oil, or *Bacillus thuringiensis* (bacteria) as active ingredients have REIs as short as 4 hours because of their low toxicity to humans. Because of the variation in REI lengths, it is important to read the label before beginning an application.

Early-entry Work Situation

The Worker Protection Standard seeks to reduce exposure by excluding workers from treated areas for a period of time after an application. PPE required for early entry into a treated site is clearly stated on the label in the “Agricultural Use” box. A worker can enter a treated area before the REI has expired under two exceptions.

1. The worker will not be contacting any surface that was treated with a pesticide. Treated surfaces (including soil), plant material (including weeds), air, and water.
2. The worker will be making contact with treated surfaces but only under certain working conditions:
 - Tasks that take less than 1 hour and do not involve hand labor
 - Tasks that take place because of an agricultural emergency
 - Specific tasks approved by the EPA through a formal exception process

Under the specific-tasks exception, the WPS allows for limited contact activities and irrigation activities when unforeseen conditions arise that, if not addressed, would result in significant economic loss. In addition, the following conditions must be met.

1. The worker has minimal, limited contact with treated surfaces. A “limited contact” task is a task other than hand labor performed by workers that results in minimal contact with treated surfaces and where such contact with treated surfaces is limited to the forearms, hands, lower legs, and feet.
2. The label does not require double notification.
3. Personal protective equipment is provided that meets the standard for early-entry workers or the generic PPE requirement (coveralls, chemical-resistant gloves and footwear, and socks).
4. No hand labor is performed.
5. The worker is not in the treated area longer than 8 hours in a 24-hour period.
6. No entry is allowed for the first 4 hours and until any required ventilation criterion or inhalation exposure level is reached.
7. Oral or written notification specific to the early-entry exception is provided to the worker.
8. All other early-entry worker requirements are met.

Early-entry workers who will contact treated surfaces must be provided with training before they enter a work area. The employer must provide both personal protective equipment and decontamination sites.

Personal Protective Equipment (PPE) Definitions

Personal protective equipment (PPE)—Apparel and devices worn to protect the body from contact with pesticides or pesticide residues include:

- Coveralls
- Chemical-resistant suits, gloves, footwear, aprons, and headgear
- Protective eyewear
- Respirators

While the following attire is not defined as PPE, the labeling might require pesticide handlers or early-entry workers to wear it for some tasks:

- Long- and short-sleeve shirts
- Long and short pants
- Shoes and socks
- Other items of regular work clothing

If such non-PPE attire is required, the employer must make sure that it is worn.

Chemical-resistant—Allows no measurable amount of the pesticide to move through the material during use.

Waterproof—Allows no measurable movement of water (or water-based solutions) through the material during use.

Chemical-resistant suit—A loosely fitting one- or two-piece chemical-resistant garment that covers, at a minimum, the entire body except for the head, hands, and feet.

Coverall—A loosely fitting one- or two-piece garment that covers, at a minimum, the entire body except the head, hands, and feet. Coveralls are made of fabric such as cotton or a cotton–polyester blend and are not chemical resistant. The pesticide labeling might specify that the coveralls be worn over a layer of clothing. (Allowable substitution: A chemical-resistant suit can be worn instead of coveralls and any required inner layer of clothing.)

Chemical-resistant apron—One made of chemical-resistant material, covering the front of the body from midchest to knees. (Allowable substitution: if a chemical-resistant suit is worn, no apron is required.)

Gloves—Hand coverings of the type listed on the pesticide label. Gloves or glove linings made of leather, cotton, or other absorbent materials must not be worn for handling or early-entry activities unless these materials are listed on the pesticide labeling as acceptable for such use. (Allowable substitution: Leather gloves may be worn over chemical-resistant liners for tasks with sharp-thorned plants. After leather gloves have been worn for such work, however, they may be worn only with chemical-resistant liners and may not be worn for any other use.)

Chemical-resistant footwear—Chemical-resistant shoes, boots, or shoe coverings worn over shoes or boots. (Allowable substitution: Leather boots may be worn in rough terrain if chemical-resistant footwear with appropriate durability and tread is unavailable.)

Protective eyewear—Goggles, face shield, or safety glasses with front, brow, and temple protection. (Allowable substitution: A full-face respirator.)

Minimum Personal Protective Equipment (PPE) and Work Clothing for Handling Activities

Toxicity Category of End-use Product				
Route of Exposure	I (Danger!)	II (Warning!)	III (Caution!)	IV (Caution!)
Dermal toxicity or skin irritation potential ¹	Coveralls worn over long-sleeve shirt and long pants Socks Chemical-resistant footwear Chemical-resistant gloves	Coveralls worn over short-sleeve shirt and short pants Socks Chemical-resistant footwear Chemical-resistant gloves	Long-sleeve shirt and long pants Socks Shoes Chemical-resistant gloves	Long-sleeve shirt and long pants Socks Shoes No minimum ²
Inhalation toxicity	Respiratory protection device	Respiration protection device	No minimum ²	No minimum ²
Eye irritation potential	Protective eyewear	Protective eyewear	No minimum ²	No minimum ²

¹If dermal toxicity and skin irritation potential are in different toxicity categories, protection shall be based on the more toxic (lower numbered) category.

²Although the WPS does not require a minimum PPE for this toxicity category and route of exposure, EPA may require PPE on a product-specific basis.

Chemical-resistant headgear— A chemical-resistant hood or hat with a wide brim.

Respirator— A device that protects the respiratory system, of the type listed on the pesticide label and appropriate for the pesticide product being used and the activity being performed. (Allowable substitution: Respirator with canister approved for pesticides, or with an organic-vapor cartridge equipped with pesticide prefilter.) Read the label for the proper type to use. The handler employer shall assure that the respirator fits correctly.

More Information on the Worker Protection Standard

1. EPA Worker Protection Standard website:
<http://www.epa.gov/oppfead1/safety/workers/amendmnt.htm>
2. Additional information and resources at:
<http://www.epa.gov/agriculture/twor.html>
3. *The Worker Protection Standard for Agricultural Pesticides—How to Comply: What Employers Need to Know* (EPA publication 735-B-93-001), available online at <http://www.epa.gov/agriculture/twor.html>
4. A companion manual insert is available at:
<http://agr.wa.gov/PestFert/Pesticides/docs/HowToComplyInsert.pdf>

Idaho

Luis Urias-Rodriguez
Idaho Department of Agriculture
Division of Agricultural Resources
PO BOX 7723
Boise, ID 83701
Tel. 208-465-8478
Fax 208-465-8471
Email lurias@agri.state.id.us

Oregon

Stan Thomas, Central Regional Health Manager
Michelle Cattanach, Consultative Services
Oregon Occupational Safety and Health Division
350 Winter St. NE, Room 430
Salem, OR 97301-3882
Tel. 503-378-3274; toll free 800-922-2689
Consultative Services tel. 503-373-7819

Washington

Ann Wick
Washington Department of Agriculture
Pest Management Division
PO Box 42560
Olympia, WA 98504-2560
Tel. 360-902-2051; toll free 877-301-4555

Pedro Serrano
Department of Labor and Industries
PO Box 44650
Olympia, WA 98504-4650
Tel. 360-902-5419

Information also is available from your local Extension educator.

Organophosphate and carbamate pesticide poisoning and cholinesterase monitoring¹

Cholinesterase (ChE) is an enzyme necessary for proper nerve impulse transmission. If the amount of this enzyme is reduced below a critical level, nerve impulses to the muscles can no longer be controlled, resulting in serious consequences, including death. Two classes of insecticides, the organophosphates and the carbamates, act as cholinesterase inhibitors; that is, they reduce the amount of cholinesterase available for the body's use. One organophosphate herbicide (Betasan) also can have this effect.

Depression of cholinesterase below the critical level may occur from a single large exposure, such as spilling a concentrate insecticide on yourself, or from a series of small exposures over a long period of time, such as applying these materials throughout a growing season. An applicator may exhibit symptoms within 48 hours after an application, after which the symptoms may disappear until the next exposure. Symptoms of overexposure to cholinesterase inhibitors include headaches, dizziness, blurred vision, nausea and vomiting, stomach cramps, diarrhea, excessive salivation and sweating, tightness of the chest, muscle twitching, and pinpoint pupils.

Persons exposed only occasionally to cholinesterase-inhibiting insecticides through residues in and around structures or landscapes, or through residues on foods, are not considered to be at risk for significant cholinesterase inhibition. **Pesticide handlers and applicators** working with organophosphates and carbamates should ask their physician about having regular cholinesterase testing done. This consists of monitoring the level of cholinesterase available in the blood throughout the application season.

Since the amount that is normal varies from person to person and fluctuates over time, it is essential to have your own **baseline cholinesterase** level established. Therefore, you must have a blood test taken at the beginning of the season, before you begin working with these pesticides. Your physician then can compare the results of subsequent cholinesterase tests to your own baseline value to determine whether the level of available cholinesterase has dropped significantly. If the red blood cell (RBC) cholinesterase drops below 70 percent or plasma cholinesterase falls below 60 percent of their respective baseline values, you must not use any organophosphate or carbamate insecticides until your cholinesterase level has returned to 80 percent of normal.²

Keep your exposure to pesticides at a minimum by following label directions, using caution during mixing and application, wearing clean protective clothing, and showering after each day of application. If you are informed that your cholinesterase level has dropped, analyze your pesticide handling practices to determine how you could reduce your exposure in the future.

Some cholinesterase inhibitors cause only minor inhibition, while others are very potent. The inhibitory effect of carbamate insecticides is reversible, and cholinesterase levels will return to normal within a relatively short time. Inhibition by organophosphates is not reversible, and levels return to normal only after the body has had enough time to manufacture new cholinesterase. Depending on the level of cholinesterase inhibition, this process may take up to 3 months.

Cholinesterase-inhibiting pesticides are identified below, listed by common name, with trade names in parentheses. However, **check the active ingredient list on the label of the pesticide** to see if it contains one of the common names listed, since not all trade names can be included here. Newly registered active ingredients or those not commonly used may not be listed here. New product labels are required to identify cholinesterase inhibitors, but the labels of older products may not have been revised to include this information.

Organophosphates

acephate (Orthene)
 azinphos-methyl (Guthion)
 bensulide (Betasan)
 carbophenothion (Trithion)
 chlorethoxyfos (Fortress)
 chlorfenvinphos (Birlane, Supona)
 chlorpyrifos (Dursban, Lorsban)
 chlorpyrifos-methyl (Reldan)
 coumaphos (Co-Ral)
 demeton (Systox)
 diazinon
 dichlorvos (DDVP, Vapona)
 dicrotophos (Bidrin)
 dimethoate (Cygon)
 dioxathion (Delnav)
 disulfoton (Di-Syston)
 EPN
 ethion
 ethoprop (Mocap)
 famphur (Warbex)
 fenamiphos (Nemacur)
 fenitrothion (Sumithion)
 fensulfthion (Dasanit)
 fenthion (Baytex)
 fonofos (Dyfonate)
 Isazophos (Miral, Triumph)
 isofenphos (Amaze, Oftanol, Pryfon)
 malathion (Cythion)
 methamidophos (Monitor)
 methidathion (Supracide)
 methyl parathion (Pennacp-M)
 mevinphos (Phosdrin)
 monocrotophos (Azodrin)
 naled (Dibrom)
 omethoate (Folimat)
 oxydemeton-methyl (MetaSystox-R)
 parathion
 phosphamidon (Dimecron)
 pirimiphos-ethyl (Primidic)
 pirimiphos-methyl (Actellic)
 profenofos (Curacron)
 propetamphos (Safrotin)
 sulprofos (Bolstar)
 temephos (Abate)
 terbufos (Counter)
 trichlorfon (Dipterex, Dylox, Proxol)

Carbamates

aldicarb (Temik)
 bendiocarb (Ficam, Turcam)
 carbaryl (Sevin)
 carbofuran (Furadan)
 fenoxycarb (Logic)
 formetanate (Carzol)
 methiocarb (Mesuro)
 methomyl (Lannate, Nudrin)
 mexacarb (Zectran)
 oxamyl (Vydate)
 pirimicarb (Pirimid)
 propoxur (Baygon)
 thiodicarb (Larvin)
 trimethacarb (Broot, Landrin)

Where Is Your Present Cholinesterase Level?



¹ Adapted from: Pesticide Information Leaflet No. 7: *Cholinesterase Testing*, Maryland Cooperative Extension (1997).

² Wilson, B.W., J.R. Sanborn, M.A. O'Malley, J.D. Henderson, and J.R. Billitti, (1997). "Monitoring the Pesticide-Exposed Worker." *Occupational Medicine* 12, 347-363.

Trade and common names of fungicides, insecticides, and miticides used in the Mid-Columbia region, and restricted entry intervals (REI)

FUNGICIDES AND BACTERICIDES			INSECTICIDES			MITICIDES		
Trade Name/Common Name/ REI (days)			Trade Name/Common Name/ REI (days)			Trade Name/Common Name/ REI (days)		
Abound	azoxystrobin	4 hr	Actara	thiamethoxam	12 hr	Acramite	bifenazate	12 hr
Agri-mycin	streptomycin	12 hr	Agri-Mek	abamectin	12 hr	Apollo	clofentezine	12 hr
Aliette	fosetyl-Al	12 hr	Ambush	permethrin	12 hr	Carzol	formetanate	4-16+
Bac-Master	streptomycin	12 hr	Asana	esfenvalerate	12 hr		hydrochloride	
BlightBan	biological	12 hr	Assail	acetamiprid	12 hr	Envidor	spirodiclofen	12 hr
Bravo	chlorothalonil	12 hr*	Avaunt	indoxacarb	12 hr	Fujimite	fenpyroximate	12 hr
Cabrio EG	pyraclostrobin	12 hr	Azinphosmethyl	azinphos-methyl	***	Kanemite	acequinocyl	12 hr
Captan	captan	1	Battalion	deltamethrin	12 hr	horticultural mineral	petroleum or	4 hr
Champ	copper hydroxide	1	Calypso	thiacloprid	12 hr	oil (HMO)	paraffinic oil	
C-O-C-S	copper oxychloride	1	Carbaryl	carbaryl	12 hr	Kelthane	dicofol	2
Dithane	mancozeb	1	Carpovirusine	codling moth	4 hr	Omite	propargite	7
Dodine	dodine	2		granulosis virus		Onager	hexythiazox	12 hr
Echo 720	chlorothalonil	12 hr*	Centaur	buprofezin	12 hr	Nexter	pyridaben	12 hr
Elevate	fenhexamid	12 hr	Chlorpyrifos	chlorpyrifos	4	Savey	hexythiazox	12 hr
Elite	tebuconazole	12 hr	Clutch	clothianidin	12 hr	Vendex	fenbutatin oxide	2
Firewall	streptomycin	12 hr	Couraze	imidacloprid	12 hr	Zeal	etoxazole	12 hr
FlameOut	oxytetracycline	12 hr	Cyd-X	codling moth	4 hr			
Flint	trifloxystrobin	12 hr		granulosis virus				
Gem 500SC	trifloxystrobin	12 hr	Cygon	dimethoate	2			
horticultural mineral	petroleum or paraffinic	4 hr	Cythion	malathion	12 hr			
oil (HMO)	oil		Danitol	fenpropathrin	1			
Indar	fenbuconazole	12 hr	Defend	dimethoate	2			
Kaligreen	bicarbonate	4 hr	Delegate	spinetoram	4 hr			
Kocide	copper hydroxide	1	Deliver	<i>Bacillus thuringiensis</i>	4 hr			
lime sulfur	calcium polysulfate	2	Diazinon	diazinon	1			
Manzate	mancozeb	1	Dimilin	diflubenzuron	12 hr			
Mycoshield	oxytetracycline	12 hr	Dipel	<i>Bacillus thuringiensis</i>	4 hr			
Nordox	copper oxide	1	Endosulfan	endosulfan	2-4*			
Orbit	propiconazole	1	Entrust	spinosad	4 hr			
Penncozeb	mancozeb	1	Esteem	pyriproxyfen	12 hr			
Polynam	metiram	1	Guthion	azinphos-methyl	***			
Pristine	pyraclostrobin plus	12 hr	horticultural mineral	petroleum or paraffinic	4 hr			
	boscalid		oil (HMO)	oil				
Procure	triflumizole	12 hr	Imidan	phosmet	3			
PropiMax	propiconazole	1	Intrepid	methoxyfenozide	4 hr			
Quintec	quinoxifen	12 hr	Javelin	<i>Bacillus thuringiensis</i>	4 hr			
Quilt	azoxystrobin plus	1	Lorsban	chlorpyrifos	4			
	propiconazole		Malathion	malathion	12 hr			
Rally	myclobutanil	1	Metasystox-R ¹	oxydemetonmethyl	2-3			
Ridomil	metalaxyl	2	Pounce	permethrin	12 hr			
Rovral	iprodione	1	Proclaim	emamectin benzoate	2			
Rubigan	fenarimol	12 hr	Provado	imidacloprid	12 hr			
sulfur	sulfur	1	Rimon	novaluron	12 hr			
Syllit	dodine	2	Sevin	carbaryl	12 hr			
Thiram	thiram	1	Success	spinosad	4 hr			
Tilt	propiconazole	12 hr	Supracide	methidathion	****			
Topsin M	thiophanate-methyl	**	Surround	kaolin clay	1			
Vanguard 75WG	cyprodinil	12 hr	Thionex	endosulfan	2-4*			
Ziram	ziram	2	Virosoft	codling moth	4 hr			
				granulosis virus				
			Vydate	oxamyl	2			
			Warrior	lambda-cyhalothrin	1			

¹Metasystox-R (Gowan Co.) is labeled for use only on certain nonbearing fruit trees. REI increases to 3 days when average rainfall is less than 25 inches per year.

* REI varies by label or formulation.

** REI for pears – 3 days; for apples – 1 day; for cherries – 12 hours.

*** REI for apples, pear, peaches, nectarines – 14 days; for cherries – 15 days.

**** REI increases from 2 to 14 days if application is over 8 pt per acre.

+ REI varies by activity.

Orchard pest management

Integrated Pest Management principles are being used successfully in Pacific Northwest orchards to manage insects, mites, diseases, and other pests. These research-based techniques provide effective monitoring methods and management practices for sustained and economical control of pests, while minimizing damage to beneficial organisms. Improved health and minimal environmental impact are benefits often cited in IPM-managed orchards using reduced pesticide programs.

The comprehensive reference, *Orchard Pest Management: A Resource Book for the Pacific Northwest*, 1993, edited by Beers, Brunner, Willet, and Warner,

was produced by research and extension personnel from the tristate region. It serves as OSU's guide to effective IPM principles for managing insect and mite pests in the state. We recommend its use in conjunction with the numerous regional OSU Extension Service Orchard Pest Management Guides produced and/or distributed in the different tree fruit districts of the state. It addresses key elements of IPM for controlling pests, including prevention, monitoring, indicating "Action Levels" or pest densities at which to apply controls, and effective alternative strategies based on current knowledge. Although designed for the commercial orchard, many principles and control considerations apply to noncommercial trees.

Cherry fruit fly control area order and Integrated Pest Management

This pest control district is intended to protect the commercial cherry industry from the Western cherry fruit fly (CFF). The presence of just one maggot is sufficient to reject a lot of cherries delivered to the processor. Area-wide suppression of this pest is the most effective way to minimize risk to the industry.

In recognition of the IPM act of 1991 as defined and mandated by ORS 634.655, whereby the Oregon Department of Agriculture is required to follow IPM principles in fulfilling its pest control responsibilities, the following: (1) addresses a source of information for obtaining and selecting elements of IPM that can be used successfully in tree fruit production in Oregon, and (2) provides acceptable cherry fruit fly management techniques that comply with the intent of OAR 603-52-150 to protect the commercial cherry industry within the control order zone.

Commercial cherry growers base CFF management on predicted emergence of overwintering adult flies from the soil using a degree day model and/or the appearance of the first flies trapped in "sticky" traps within or near the orchard. Sometimes a "sentinel" tree or area known to be infested with CFF is used to determine first emergence with sticky traps. The most suitable insecticide for a

given operation is selected from this guide and applied to the trees beginning no later than 7 days after CFF emergence. Depending upon the insecticide chosen, repeat applications may be necessary to assure no maggots infest the fruit. Postharvest insecticide applications often are necessary in commercial orchards because of fruits left on trees, the long flight period of CFF, and the short residual nature of most insecticides used. Tree height and canopy influence effectiveness of sprays. Shorter trees pruned to open canopy interiors allow for more effective coverage and penetration. Evaluation of commercial CFF control programs is based on fruit inspections at receiving plants, by ODA officials, and at port of entry for exported fruit.

Noncommercial cherry trees should be managed in the same manner in regard to CFF control. General-use insecticides presented in this guide can be used and timed as above.

Methods other than insecticidal sprays that can be used are designed to prevent the presence of fruit when egg-laying flies are present. These include (1) tree removal, (2) removal of all bloom from trees, (3) removal and proper disposal of fruit before CFF emergence.

Internet resources for plant protection in the Mid-Columbia area

Information regarding plant protection is available from OSU and other sources.

Weather data and pest models for the Mid-Columbia region are available at: <http://ippc2.orst.edu/hr/> and <http://www.ifpnet.com/>

Specific models may be accessed through websites managed by the OSU Integrated Plant Protection Center.

Codling moth development information is available at: <http://ippc2.orst.edu/cgi-bin/ddmodel.pl?clm>

Apple scab infection season information is available at: <http://ippc2.orst.edu/cgi-bin/ddmodel.pl?spp=asc>

Pear scab infection **season** information is available at: <http://ippc2.orst.edu/cgi-bin/ddmodel.pl?spp=asp>

Pear scab infection **period** information for the Hood River Valley is available at: <http://ippc2.orst.edu/hr/>

Fire blight risk information is available at: <http://ippc2.orst.edu/cgi-bin/ddmodel.pl?fb1>

OSU Botany and Plant Pathology Department. Site of "Online Guide to Plant Disease Control." Disease symptom descriptions, pictures of disease symptoms, and other information helpful in plant protection are available at: <http://plant-disease.ippc.orst.edu/>

Pacific Northwest Insect Management Handbook: <http://insects.ippc.orst.edu/pnw/insects>

Pacific Northwest Weed Management Handbook: <http://weeds.ippc.orst.edu/pnw/weeds>

Suggested best management practices for orchard spraying

The OSU Extension Service is working with the Hood River Grower-Shipper Association, local packing houses, and chemical suppliers to help protect our water resources while ensuring the continued availability of chemical crop protection tools. The following practices should help minimize the possibility of pesticides and herbicides entering our waterways. You should review your operations and consider adjusting your practices as necessary to follow these recommendations.

These practices are most appropriate for orchards located in **sensitive areas** (those within 100 ft of open surface water, including creeks, streams, irrigation ditches, farm ponds, etc.). While these spray practices are recommended specifically for orchards near open surface waters, they may help minimize the possibility of pesticides entering other sensitive areas such as schools, residential areas, and public roads. Season-specific (e.g., prebloom and postbloom) recommendations are not made in this guide. Specific suggestions for pre- and postbloom control programs for orchards in sensitive areas will be provided in Extension Service newsletters.

Cultural practices

- Maintain at least 20 ft between orchards and waterways, including streams, ditches, drainageways, and ponds.
- Reduce runoff that might contain pesticides by planting and maintaining cover crops to increase water penetration and intercept runoff.
- Establish windbreaks between orchards and sensitive areas.

Mixing and loading

- Mix and load sprayers in areas where runoff to surface water cannot occur. Maintain an air gap between filler pipes and sprayers to reduce backflow.
- Rinse pesticide containers when filling sprayers and mix rinsate back into spray tank. Store rinsed plastic containers away from waterways and recycle; do not burn.
- Do not overfill sprayers. Use antifoaming agents to reduce the risk.

- Apply spray tank rinse water back into the orchard; do not drain it in one spot.
- Clean up spills immediately. Have spill-adsorbent material (cat litter, sawdust, etc.) available when mixing and loading.

Maintenance and calibration

- Maintain and service equipment on a regular basis to avoid leaks, especially valves and hoses.
- Calibrate sprayers to avoid overapplication and reduce drift.

Application

- Minimize drift to waterways by increasing droplet size, using drift retardant, and avoiding application in high winds.
- Turn off nozzles at the end of each tree row.
- Make all efforts to eliminate drift near the edge of the orchard. When spraying rows parallel to sensitive areas, spray only the outside of the outer two rows. Spray inwards at a lower speed for improved coverage.
- When spraying rows perpendicular to sensitive areas, turn off nozzles two to three trees from the end of each row. Then return and spray the last two to three trees inwards at a lower speed.
- Apply dormant sprays with at least 200 gallons of water per acre for increased droplet size and reduced drift.
- Spray sensitive areas in the lowest wind conditions. When winds die down, move to these areas before finishing the rest of the block.

The Hood River Grower-Shipper Association and OSU-MCAREC have produced the Best Management Practices for Pesticide Use Handbook. It is available online at:

<http://community.gorge.net/hrgsa/bmproject.html>

Dilutions for wettable powder and liquid products

Quantities of Material for Indicated Quantities of Water*

Type of Material	100 gallons	5 gallons	3 gallons	1 gallon
Wettable powder	5 lb	4 oz	2.4 oz	0.8 oz
	4 lb	3.2 oz	1.92 oz	0.64 oz
	3 lb	2.4 oz	1.44 oz	0.48 oz
	2 lb	1.6 oz	0.96 oz	0.32 oz
	1 lb	0.8 oz	0.48 oz	0.16 oz
	0.5 lb	0.4 oz	0.24 oz	0.08 oz
Liquid products	5 gal	1 qt	1 pt, 3 oz	6.5 oz
	4 gal	1 pt, 9 oz	15 oz	5 oz
	3 gal	1 pt, 3 oz	11.5 oz	7.5 Tbl
	2 gal	13 oz	7.5 oz	5 Tbl
	1 gal	6.5 oz	4 oz	2.5 Tbl
	1 qt	10 tsp	2 Tbl	2 tsp
	1 pt	5 tsp	1 Tbl	1 tsp

*The weight per volume of dry formulated products varies. To ensure accurate dilutions, measure these products by weight only.

Pesticide resistance management

Causes of pest control failures

Pest control failures in the field can have many causes. Often, they are related to the spray application itself. A grower may have chosen a pesticide that is ineffective against a specific pest and is not appropriate for the intended purpose. Even if the correct pesticide was used, the rate may have been too low to be effective, or the spray application may have been made at a less-than-optimal time. Other causes of poor control may be related to problems with the spraying equipment, spraying operation, or weather conditions (such as wind and rain during and after the application) that resulted in insufficient spray coverage of the tree canopy. One cause of pest control failures, which is more difficult to diagnose, is the development of resistance to a pesticide.

Resistance development

When a pesticide fails to provide control in the field and other causes for the control failure have been ruled out, resistance development is likely. Resistance manifests itself in the field by the inability to achieve control of pests at rates that previously were effective. Resistance development is a genetic phenomenon, and it occurs when pest populations are exposed repeatedly (over many generations) to the same pesticide or to groups of chemically related pesticides. Through selection, pest populations lose their susceptibility to a pesticide and become resistant. Depending on the pest species involved and the intensity of selection, resistance may develop very rapidly, as in the case of spider mites, or more slowly, as in the case of codling moth. Often, selection with one type of pesticide confers resistance to others of similar chemistry. This is called cross-resistance.

Fruit growers in the Mid-Columbia area have first-hand experience with resistance development and its consequences. For instance, in the early 1950s codling moth developed resistance to DDT after 6 to 8 years of continuous use. Guthion, at one time an all-purpose pesticide for insect and mite control on tree fruits, became ineffective against spider mites and pear psylla only a few years after it was introduced in the 1960s. Development of resistance in pear psylla to pyrethroid insecticides and in spider mites to organotin miticides provides more recent examples of resistance episodes. The practical outcome of resistance development is that growers lose control tools that previously were effective.

How to cope with resistance development in a proactive way

Fortunately, growers can do something about resistance development and prevent or at least delay it in the field by adopting resistance management strategies. Growers are the ones who make pest control choices and decide how pesticides are used in their orchards. Therefore, through their actions they directly influence the speed and intensity of resistance development in the field. A grower who uses pesticides conservatively and applies them sparingly likely will have fewer resistance problems than a grower who does the opposite.

Chemical use strategies for resistance management

An important principle in resistance management is the concept of moderation in order to reduce selection pressure from pesticides and extend their effective field life. In practical terms, this means reducing overall chemical use by:

- Using the lowest effective rate of pesticides when appropriate
- Using higher treatment thresholds to reduce the frequency of applications

- Using pesticides with shorter residual activity to avoid selection over several generations
- Treating only those areas in an orchard where the pest density has exceeded the economic threshold

A common method of trying to overcome resistance is to use high rates of a pesticide. Most likely, a **high-dose strategy rarely works** and only accelerates resistance development. Use of high rates also is detrimental to natural enemies and the environment and is not compatible with IPM programs.

Rather than resorting to the use of higher rates, growers should **alternate pesticide chemistries with different modes of action** and follow the pesticide use recommendations outlined above. The term *mode of action* refers to the way a pesticide kills a target pest, and it varies greatly among available pesticides. Most pesticides used in tree fruits, such as organophosphates, carbamates, neonicotinoids, and pyrethroids, are nerve poisons. Others, such as insect growth regulators, interfere with the hormonal control of insect development. Some have a physical mode of action such as horticultural mineral oil (HMO), which kills by suffocation, or kaolin clay, which disrupts soft insect membranes, leading to dehydration. Microbial insecticides, such as the codling moth granulosis virus, provide control by causing disease in a population. There also are behavioral control methods such as mating disruption, which provide control by interfering with the reproductive behavior of certain insect pests. Growers should have some knowledge of how different pest control tactics work in order to build an effective resistance management program.

Resistance management as part of IPM in tree fruits

A grower who wants to take an active part in managing resistance should adopt an integrated pest management (IPM) program:

- Use alternatives to chemical pesticides whenever possible.
- Reduce the frequency of pesticide applications to a minimum.
- Make appropriate pesticide choices based on their mode of action and potential for resistance development.

Experience has shown that the risk for resistance development depends on the mode of action of a pesticide or pest control tactic. Pest control tactics such as biological control, cultural controls, microbial agents, and tactics with a behavioral (mating disruption) or physical (HMO) mode of action have a lower resistance risk and should be given preference in a seasonal IPM program. Chemical pesticides that act as nerve poisons or interfere with the hormonal regulation of insect development are much more prone to resistance development and should be used with moderation to preserve their field life.

Resistance management begins with the individual grower. However, it is most effective when resistance management approaches are adopted on an area-wide scale and used by the majority of growers in an area.

In summary, resistance management is most successful where growers monitor pests, use treatment thresholds and avoid prophylactic treatments, and take advantage of a range of nonchemical control tactics. IPM is the ultimate resistance management strategy for preserving valuable pesticides for managing key pests. Avoiding the loss of control tools due to resistance is every grower's responsibility. In an age when few new pesticides are being registered, loss of a pesticide can be a serious problem threatening the ability of growers to maintain adequate control and produce a high-quality, blemish-free crop.

Natural enemy impact guide for tree fruit pesticides

This table is intended as a guide to the relative impact of commonly applied pesticides on natural enemies that are important components of an integrated pest management program on tree fruits. Use it in conjunction with the pest control program for each fruit crop. These programs give recommended rates and timing of sprays. The impact of some pesticides on natural enemies may vary considerably with the history of use in a given orchard. This is especially true relative to the effect on the western predatory mite (WPM) and the apple rust mite (ARM). Information in this table was obtained from the *Crop Protection Guide for Tree Fruits in Washington* (EB 0419) and other sources.

Compound	Trade name	Rate/acre	Relative impact rating ¹						
			WPM ²	ARM ³	Colpoclypeus florus ⁴	Pnigalio flavipes ⁴	Coccinellids ⁵	Lacewing	Mirids ⁶
abamectin	Agri-Mek	10-20 oz	H ⁷	H ⁷	M ⁷	M ⁷	M ⁷	–	H
acetamiprid	Assail 70WP	3.4 oz	L	L	M	M	M	–	H
azadirachtin	Neemix 4.5%	7 oz	–	–	L	–	L	–	–
azinphos-methyl	Guthion 50WP	2 lb	L	L	H	L	H	–	H
<i>Bacillus thuringiensis</i> (B.t.)	Deliver, Dipel, Javelin	1-2 lb	L	L	L	L	L	–	L
buprofezine	Centaur 70WDG	34.5 oz	–	–	–	–	–	–	–
carbaryl	Sevin 50WP	2 lb	M-H	L-M	H	L	H	L	–
chlorpyrifos	Lorsban 4E	2-4 pt	L-M	L	H	H	H	–	–
chlorpyrifos	Lorsban 50WP	3 lb	L-M	L	H	H	H	L	–
clofentezine	Apollo 50SC	4-8 oz	L	L	–	–	–	–	L
codling moth granulosis virus	Carpovirusine, Cyd-X	13.5 oz 3 oz	L	L	L	L	L	L	L
diazinon	Diazinon 50WP	4 lb	L	L	H	–	H	–	–
dimethoate	Dimethoate 2.67EC	2 qt	L-M	L	H	–	H	–	–
endosulfan	Thionex 50W	3 lb	L	M-H	M	M	M-H	L	–
esfenvalerate	Asana 0.66EC	1 pt	H	L	M	M-H	–	L	H
etoxazole	Zeal 72WDG	2-3 oz	L-M	–	–	–	–	–	–
fatty acids (soap)	M-Pede	1-2% v/v	M ⁷	M ⁷	–	–	L	L	–
fenbutatin-oxide	Vendex 50WP	1.5 lb	M	H	L	–	L	–	–
fenpropathrin	Danitol 2.4EC	20 oz	H	–	–	–	–	–	H
formetanate hydrochloride	Carzol 92SP	1.5 lb	M-H	M-H	H	–	L	–	–
hexythiazox	Onager 1EC	16-24 oz	L	L	–	–	–	–	L
hexythiazox	Savey 50DF	3-6 oz	L	L	–	–	–	–	L
horticultural mineral oil	–	1-2% v/v	M ^{7,8}	L ⁸	L	L	L	L	L
imidacloprid	Provado 1.6F	4-8 oz	L ⁹	L ⁹	M ⁷	–	M	L	H
indoxacarb	Avaunt 30WG	5-6 oz	L ¹⁰	L ¹⁰	–	–	–	–	–
kaolin	Surround WP	50 lb	M-H	–	–	M	M-H ⁵	–	–
lime sulfur	–	6 gal	M	H	–	–	–	–	–
methomyl	Lannate 1.8L	2 pt	H	L	–	–	–	–	–
methomyl	Lannate 90SP	0.5 lb	H	L	–	–	–	–	–
methoxyfenozide	Intrepid 2L	10 oz	L	L	L	L	L	L	L
oxamyl	Vydate 2L	2-4 pt	M-H	–	H	L-M	M	L	–
permethrin	Ambush 2EC	20 oz	H	L	M	–	–	–	H
permethrin	Pounce 3.2EC	4-8 oz	H	L	M	–	–	–	H
phosmet	Imidan 70WP	3-5.33 lb	L	L	H	L	H	L	H
pyridaben	Nexter 75WP	4.4-7 oz	M	H	–	–	–	–	M
pyriproxyfen	Esteem 35WP	4-5 oz	L	L	–	–	M-H	–	M
spinosad	Success 2L	6-10 oz	L	–	M-H	H	L	L	L
thiacloprid	Calypso 4F	2-8 oz	L	L	–	–	–	–	H
thiamethoxam	Actara 25WDG	5.5 oz	L ⁹	L ⁹	–	–	–	–	H

¹Rating system: L = low impact; M = moderate impact; H = high impact; – = no data available

²WPM = western predatory mite, *Typhlodromus occidentalis*.

³ARM = apple rust mite, *Aculus schlechtendali*. Although ARM is a plant-feeding species, it is very useful in maintaining populations of the western predatory mite.

⁴*C. florus* is a wasp parasitoid of leafrollers; *P. flavipes* is a wasp parasitoid of western tentiform leafminer.

⁵Coccinellid data based on bioassays of late instar larvae of *Hamonia axyridis*, *Hippodamia convergens*, and *Coccinella transversoguttata*. Kaolin data based on bioassays using *Stethorus punctum*.

⁶*Deraeocoris brevis*.

⁷Overall negative impact is reduced due to short residual activity.

⁸Spray volume may be important in determining toxicity.

⁹Preliminary data based on field trials of four cover sprays.

¹⁰Preliminary data based on field trials with a single application.

Spotts model for estimating pear scab infection periods

Average temperature (°F) during leaf wetness	Minimum hours of leaf wetness required for infection
45	25
46	22
48	19
50	17
52	15
54	13
55	12
57	12
59	11
61	11
63	10
64	10
66	10
68	10
70	10
72	10
73	10
75	10

In the fall, examine all leaves on 10 shoots on each of 10 trees located throughout the orchard. If you find fewer than 6 leaves with scab, the overall risk from scab is low enough to skip the first fungicide spray at pink. The end of ascospore infection season occurs after the first rain following the accumulation of 1,620 degree days from budswell.

Twelve steps to manage bacterial canker of sweet cherry

Dr. Robert A. Spotts

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Pseudomonas syringae, which causes bacterial canker, is a major bacterial pathogen of young sweet cherry trees. Often, 10 to 20 percent of the trees in new orchards are killed by *P. syringae* within 5 years of planting. Control must integrate several techniques, including the following:

1. Do not interplant new trees with old trees, which are major sources of *P. syringae*.
2. Keep irrigation water off the part of the trees above ground as much as possible for the first 2 or 3 years after planting. Consider withholding water in late summer so trees will "harden off" and not be as susceptible to low temperature injury in early winter.
3. Avoid all types of injury—mechanical, insect, frost. Paint all trunks white with latex paint to prevent winter injury. Adding copper to the paint is probably of little benefit.
4. Some studies show less bacterial canker when pruning is delayed until spring, even as late as after flowering in May. Less disease also occurs when summer pruning is used. Prune only during dry weather if possible.
5. Remove branches and trees killed by *P. syringae* from the orchard and destroy them.
6. Mazzard F12-1 is one of the most resistant rootstocks. Resistance of new rootstocks is unknown at this time, but trees on Mazzard may have an advantage over trees on size-controlling rootstocks. Sweet cherry scion cultivars generally are susceptible.
7. Locate the orchard in an area less likely to be affected by frost and slow drying conditions.
8. Provide optimal soil conditions for growth of cherries, including attention to pH and nutrition. Application of excess nitrogen, especially late in the growing season, will promote late-season growth that is susceptible to low temperature injury in early winter, followed by bacterial infection.
9. Control weeds. They often support large populations of *P. syringae*, especially grasses. Clover and vetch ground covers support lower populations. Consider clean cultivation of row middles for the first 3 years.
10. Fixed copper products or Bordeaux 12-12-100, applied in October and January, may help, but strains of *P. syringae* resistant to copper are widespread in the Mid-Columbia area.
11. Test for and control plant pathogenic nematodes before planting if needed. High populations of ring nematode have been associated with more bacterial canker.
12. In the Parkdale area, plant trees in May rather than April.

Apple scab infection

Approximate hours of wetness at indicated temperatures required for leaf scab infection, and days required for lesions to appear.

Average temperature (°F)	Hours of wetness required for infection ^a			Days required for lesions to appear ^b
	From primary or secondary inoculum			
	Light	Moderate	Heavy	
78	13	17	26	
77	11	14	21	
76	9.5	12	19	
63-75	9	12	18	10
62	9	12	19	10
61	9	13	20	10
60	9.5	13	20	11
59	10	13	21	12
58	10	14	21	12
57	10	14	22	13
56	11	15	22	13
55	11	16	24	14
54	11.5	16	24	14
53	12	17	25	15
52	12	18	26	15
51	13	18	27	16
50	14	19	29	16
49	14.5	20	30	17
48	15	20	30	17
47	15	23	35	
46	16	24	37	
45	17	26	40	
44	19	28	43	
43	21	30	47	
42	23	33	50	
41	26	37	53	
40	29	41	56	
39	33	45	60	
38	37	50	64	
37	41	55	68	
33-36	48	72	96	

From W.D. Mills, Cornell University

^aLeaves remain wet for varying lengths of time after the rain stops, depending on conditions. Add together wetting periods from intermittent showers. Other states such as Michigan add together any wet periods with less than 8 hours dry time between them. Determine average temperature for the period from hourly readings. Lesions may not be apparent for 2-4 weeks.

^bDays required for conidia to appear once infection has been established. No further wetting is required. For this column, daily maximum and minimum temperatures are adequate for determining the average.

Bud development chart

Stage

Apple

Pear

Peach/Apricot

Cherry/Plum

0



1



2



3



4



5



6



7



Courtesy Washington State University Extension

2008 Mid-Columbia pest control program for pears

Application rates in the tables are for dilute sprays, generally estimated as 400 gallons per acre. Gallonage requirements vary depending on tree size, shape, and spray equipment. Large, heavily barked trees infested with scale insects may need to be sprayed with more than 400 gallons of spray solution per acre, but never exceed the labeled rate per acre. Base CONCENTRATE SPRAYS on the amount of formulation given per acre unless indicated otherwise on a product's label.

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. **MATERIALS ARE LISTED ALPHABETICALLY.**

Integrated Fruit Production (IFP) is "the economical production of high-quality fruit which gives priority to ecologically sound methods and minimizes side effects and use of agricultural chemicals, thereby protecting the environment and human health."

IFP preference rankings were established for pesticides and herbicides registered for pears and apples. Most-preferred materials are given a #1, materials with lower preference (intermediate) are designated #2, and least preferred but permitted materials are listed as #3. The leaching potential, soil sorption, material toxicity, efficacy, preharvest interval, soil half-life, effects on beneficials, and biological disruption of each material were considered when drawing up the ranking list.

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
Dormant spray (Stage 1)							
Pear psylla [#] adults and eggs	1. Horticultural mineral oil (HMO)	4-6 gal	1-1.5 gal	4 hr	—	1	1. Apply just prior to egg deposition. It is recommended not to exceed 8 gal oil/A prebloom.
	2. Surround WP	50 lb	25 lb	1	0	1	2. Apply in 200 gal of water at beginning of pear psylla egg laying. Maintain coverage until bloom with additional applications to prevent egg laying.
Pear psylla ^{***} adults and eggs, scale	1. HMO	4-6 gal	1-1.5 gal	4 hr	—	1	1. It is recommended not to exceed 8 gal oil/A prebloom.
	+ a. Asana XL*	10-19 oz	2.5-4.75 oz	12 hr	28	3	a, b, c, d. Asana, Danitol, Pounce, and Warrior are very toxic to bees and fish. Use appropriate caution.
	b. Danitol 2.4 EC*	16-21 oz	4-5.25 oz	24 hr	14	3	
	c. Pounce 3.2EC*	8-16 oz	2-4 oz	12 hr	prebloom	3	
	d. Warrior 1SC*	2.56-5.12 oz	0.64-1.28 oz	24 hr	21	3	d. Do not exceed 0.2 lb ai (1.6 pt)/A/year or 0.16 lb ai (1.2 pt)/A/year postbloom.
Pear rust mite, blister mite	1. HMO	4-6 gal	1-1.5 gal	4 hr	—	1	1. Apply before bud swell. It is recommended not to exceed 8 gal oil/A prebloom. HMO + sulfur will also provide 70-80% control of pear psylla adults.
	+ a. dry flowable sulfur	15-20 lb	3.75-5 lb	1	—	1	
	b. flowable sulfur	1-2 gal	1-2 qt	1	—	1	
	c. lime sulfur	10 gal	2.5 gal	2	—	1	

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
Delayed dormant spray (Stages 2 and 3) Apply before bud scales start to drop to minimize injury.							
Pear psylla adults ^{***} , European red mite, San Jose scale, European fruit scale, lygus bug	1. HMO	4-6 gal	1-1.5 gal	4 hr	—	1	1. If scale is a problem, increase gallonage. Calibrate to discharge $\frac{2}{3}$ of volume out of top $\frac{1}{3}$ of sprayer. The $\frac{2}{3}$ - $\frac{1}{3}$ calibration should be used for all sprayers and all applications. It is recommended not to exceed 8 gal oil/A prebloom. a, b, c, f, and g. Asana, Battalion, Danitol, Pounce, and Warrior are very toxic to bees and fish. Use appropriate caution. b. Do not exceed 26.9 oz/A/year. d. HMO + Dimilin does not control lygus bugs. e. Do not exceed 2 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies. g. Do not exceed 0.2 lb ai (1.6 pt)/A/year or 0.16 lb ai (1.2 pt)/A/year postbloom.
	+ a. Asana XL*	10-19 oz	2.5-4.75 oz	12 hr	28	3	
	b. Battalion 0.2EC*	7-14 oz	1.75-3.5 oz	12 hr	21	3	
	c. Danitol 2.4EC*	16-21 oz	4-5.25 oz	24 hr	14	3	
	d. Dimilin 2L	40-48 oz	10-12 oz	12 hr	14	1	
	e. endosulfan 3EC (Thionex 3EC*, Endosulfan 3EC*)	3.33 qt	0.83 qt	2	7	3	
	f. Pounce 3.2EC*	8-16 oz	2-4 oz	12 hr	prebloom	3	
g. Warrior 1SC*	2.56-5.12 oz	0.64-1.28 oz	24 hr	21	3		
Pear psylla [†] , scale, leafrollers [‡]	1. HMO	4-6 gal	1-1.5 gal	4 hr	—	1	1. It is recommended not to exceed 8 gal oil/A prebloom. a. Do not exceed 2 applications or 10 oz/A/year.
	+ a. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	45	1	
Scales, lygus bug, grape mealybug, stink bug, leafrollers [#]	1. HMO	4-6 gal	1-1.5 gal	4 hr	—	1	1. It is recommended not to exceed 8 gal oil/A prebloom. c. Increase REI to 14 days if application is over 8 pt per acre.
	+ a. diazinon 50WP*	4 lb	1 lb	2	21	2	
	b. Lorsban 4E*	2 qt	1 pt	4	prebloom	2	
	c. Supracide 2E*	6-8 pt	1.5-2 pt	2-14	prebloom	3	

DELAYED DORMANT CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Delayed dormant spray (Stages 2 and 3) Apply before bud scales start to drop to minimize injury.							
Pear rust mite, blister mite	1. HMO	4-6 gal	1-1.5 gal	4 hr	—	1	1. Apply at stage 2 only as long as scales protect buds before bud swell. It is recommended not to exceed 8 gal oil/A prebloom. HMO + sulfur will also provide 70-80% control of pear psylla adults.
	+ a. dry flowable sulfur	15-20 lb	3.75-5 lb	1	—	1	
	b. flowable sulfur	1-2 gal	1-2 qt	1	—	1	
	c. lime sulfur	10 gal	2.5 gal	2	—	1	
Pseudomonas, blossom blast, fireblight [#]	1. Fixed copper (50-53%)	16 lb	4 lb	1	—	1	1. See footnote 5, page 41.
	+ a. HMO	4-6 gal	1-1.5 gal	4 hr	—	1	a. It is recommended not to exceed 8 gal oil/A prebloom.
Cluster bud to pink (Stages 4, 5, and 6)							
Leafrollers [#]	1. <i>Bacillus thuringiensis (B.t.)</i> (Deliver, Dipel, Javelin)	Rates vary, see label		4 hr	1	1	1. Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays usually are needed. Pink and petal fall sprays are most critical. Apply sprays 14-21 days apart. Complete coverage is necessary for good control.
	2. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1	2. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	3. Entrust 80WP	2-3 oz	0.5-0.75 oz	4 hr	7	1	3. Do not exceed 3 applications for leafroller control per year. Do not exceed 9 oz/A/year.
	4. Intrepid 2F	16 oz	4 oz	4 hr	14	1	4. Make 1-2 applications against overwintering generation larvae depending on pest pressure. Apply with spreader-sticker to increase efficacy. Do not apply more than 64 oz/A/year.
	5. Proclaim 5SG*	3.2-4.8 oz	0.8-1.2 oz	2	14	1	5. Toxic to bees. Use appropriate caution. Do not exceed 14.4 oz/A/year.
	6. Success 2L	6-10 oz	1.5-2.5 oz	4 hr	14	1	6. Do not exceed 3 applications for leafroller control per year. Do not exceed 29 oz/A/year. Do not apply treatments less than 14 days apart.

CLUSTER BUD TO PINK CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Cluster bud to pink (Stages 4, 5, and 6)							
Pear psylla adults**	1. Asana XL†*	10-19 oz	2.5-4.75 oz	12 hr	28	3	1, 2, 3, 4, 5, 6. Asana, Battalion, Danitol, Pounce, and Warrior are very toxic to bees and fish. Use appropriate caution.
	2. Battalion 0.2EC†*	7-14 oz	1.75-3.5 oz	12 hr	21	3	2. Do not exceed 26.9 oz/A/year.
	3. Danitol 2.4EC†*	16-21 oz	4-5.25 oz	24 hr	14	3	
	4. endosulfan 3EC (Thionex 3EC*, Endosulfan 3EC*)	3.33 qt	0.83 qt	2	7	3	4. Do not exceed 2 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies.
	5. Pounce 3.2EC†*	8-16 oz	2-4 oz	12 hr	prebloom	3	
	6. Warrior 1SC*	2.56-5.12 oz	0.64-1.28 oz	24 hr	21	3	6. Do not exceed 0.2 lb ai (1.6 pt)/A/year or 0.16 lb ai (1.2 pt)/A/year postbloom.
Pear psylla#	1. Centaur 70WDG	34.5 oz	8.62 oz	12 hr	14	1	1. Do not exceed 2 applications or 69 oz/A/year, 7-day minimum interval
	2. Dimilin 2L	40-48 oz	10-12 oz	12 hr	14	1	2. Apply with 0.25% HMO v/v.
	3. Surround WP	50 lb	25 lb	1	0	1	3. Apply in 200 gal of water.
Pear psylla#, leafrollers#, and green fruit worm	1. Proclaim 5SG*	3.2-4.8 oz	0.8-1.2 oz	2	14	1	1. Toxic to bees. Use appropriate caution. Do not exceed 14.4 oz/A/year.
Pear psylla#, leafrollers#, and San Jose scale	1. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	45	1	1. Apply as overwintering leafroller larvae become active. Will provide leafroller suppression as part of a season-long program. Do not exceed 2 applications or 10 oz/A/year.
Pear psylla#, pear rust mites, green fruit worm, lygus and stink bugs, thrips	1. endosulfan (Thionex 50W*)	4-5 lb	1-1.25 lb	4	7	3	1. Toxic to bees and fish. Use appropriate caution. Do not exceed 2 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies.
Pear psylla#, pear rust mites, spider mites#	1. Fujimite 5EC	2 pt	8 oz	12 hr	14	1	1. Toxic to fish. Use appropriate caution. Do not exceed 2 applications or 32 oz/A/year.
	2. Nexter 75WP	4.4-7.0 oz	1.1-1.8 oz	12 hr	7	1	2. Use higher rate for pear psylla control. Toxic to bees and fish. Use appropriate caution. Do not exceed 1 application or 10.67 oz/A/year.

CLUSTER BUD TO PINK CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED— Cluster bud to pink (Stages 4, 5, and 6)							
Pear psylla [‡] , aphids, mealy bug	1. Actara 25WDG	5.5 oz	1.37 oz	12 hr	35	2	1. Do not exceed 16.5 oz/A/year. Observe 10-day interval between applications. Toxic to bees. Use appropriate caution. Apply at early pink.
	2. Assail 70WP	1.1-3.4 oz	0.27-0.85 oz	12 hr	7	2	2&3. Toxic to bees. Use appropriate caution. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 12-day interval between applications.
	3. Assail 30SG	2.5-8 oz	0.64-2 oz	12 hr	7	2	3. See remark 2 above.
	4. Calypso 4F	4-8 oz	1-2 oz	12 hr	30	2	4. Do not apply more than 16 oz/A/year.
Pear rust mites, spider mites [#]	1. Envidor 2SC	18 oz	4.5 oz	12 hr	7	1	1. Toxic to bees. Use appropriate caution. Do not exceed 1 application or 18 oz/A/year.
Thrips, lygus, and stink bugs	1. endosulfan (Thionex 50W*)	4-5 lb	1-1.25 lb	4	7	3	1. Toxic to bees and fish. Use appropriate caution. Do not exceed 2 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies.
	2. Carzol	1-1.25 lb	4-5 oz	4	—	3	2. Apply at night when bees are not present. Do not apply after petal fall. Do not exceed 1.25 lb/A/yr. REI increases to 16 days when foliage is out.
Powdery mildew See footnote 1, page 41	1. Flint 50WG	2-2.5 oz	0.5-0.62 oz	12 hr	14	1	1. Do not exceed 4 applications per year. See footnote 6, page 41.
	2. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	2. Do not exceed 4 applications per year. See footnote 6, page 41.
	3. Procure 480SC	8-16 oz	2-4 oz	12 hr	14	1	3. Do not exceed 64 oz/A/year.

CLUSTER BUD TO PINK CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED— Cluster bud to pink (Stages 4, 5, and 6)							
Scab See footnote 1, page 41	1. Flint 50WG	2-2.5 oz	0.5-0.62 oz	12 hr	14	1	1. Do not exceed 4 applications per year. See footnote 6, page 41. 2. Do not apply more than 21 lb/A/year at 3-lb rate or 24 lb/A/year at 6-lb rate. See footnote 4, page 41. 3. Do not exceed 4 applications per year. See footnote 6, page 41. 4. Do not exceed 64 oz/A/year.
	2. mancozeb 75DF	3-6 lb	0.75-1.5 lb	1	77	1	
	3. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	
	4. Procure 480SC	8-16 oz	2-4 oz	12 hr	14	1	
	5. Syllit FL	4.5 pt	18 oz	2	7	1	

Bloom

Fireblight	1. BlightBan A506	5-7 oz	See remarks.	4 hr	—	—	1, 2, 3. For best results, use predictive model (Cougarblight) to time applications. 1. Use the 5 oz rate in 50-150 GPA and the 7 oz rate in 200-300 GPA. Use at 20% and again at 50% bloom. Works best at the beginning of an infection period. Do not use with terramycin or copper-based products. Must be integrated with other fireblight control tactics. The addition of chelated iron as Sequestrene 138 at 1 lb/100 gal water in a tank mix with Blightban improves disease control over BlightBan alone. This is a safe and legal use; however, it would remove the registrant from any legal/financial responsibility. Do not use straight iron sulfate in the tank mix as that use will burn flowers and russet fruit. 2. Do not exceed 1 lb per 100 gal of water. 2-year shelf life. 3. Apply terramycin 17% at the rate of 8 oz in 50 gal or 16 oz in 100 gal of water. Do not use higher gallonages because the effectiveness of terramycin is reduced.
	2. Streptomycin (Agrimycin 17, Bac-Master, Firewall, Farmsaver Agricultural Streptomycin, etc.)	Depends on formulation, see label	See remarks.	12 hr	30	1	
	3. Terramycin (Mycoshield, FlameOut)	0.5-1 lb	See remarks.	12 hr	60	1	

NOTE: Extensive resistance to streptomycin has been found throughout the Mid-Columbia area.

BLOOM CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Bloom							
Codling moth	1. Checkmate CM-XL 1000	120-200 ties	NA	—	0	1	1, 2, 3, 4. Other products are available, but experience is limited with those products. If pest pressure is high, combine with one or more insecticides against the first generation. Treat with insecticides against the second generation if pressure remains high. If lower application rates are used, supplemental treatment with insecticides may be necessary.
	2. Isomate-C Plus	400 ties	NA	—	0	1	
	3. Isomate-CTT	200 ties	NA	—	0	1	
	4. Nomate CM	300-400 ties	NA	—	0	1	
Petal fall							
Bulls-eye rot, scab	1. mancozeb 75DF	3 lb	0.75 lb	1	77	1	1. Do not apply more than 21 lb/A/year. See footnote 4, page 41. 2. See footnote 3, page 41.
	2. ziram 76DF	6-8 lb	1.5-2 lb	2	5	1	
Powdery mildew See footnote 1, page 41	1. Flint 50WG	2-2.5 oz	0.5-0.62 oz	12 hr	14	1	1. Do not exceed 4 applications per year. See footnote 6, page 41. 2. Do not exceed 4 applications per year. See footnote 6, page 41. 3. Do not exceed 64 oz/A/year.
	2. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	
	3. Procure 480SC	8-16 oz	2-4 oz	12 hr	14	1	
	4. Rubigan EC	8-12 oz	2-3 oz	12 hr	30	2	
Scab See footnote 1, page 41	1. Flint 50WG	2-2.5 oz	0.5-0.62 oz	12 hr	14	1	1. Do not exceed 4 applications per year. See footnote 6, page 41. 2. Do not apply more than 21 lb/A/year at 3-lb rate or 24 lb/A/year at 6-lb rate. See footnote 4, page 41. 3. Do not exceed 4 applications per year. See footnote 6, page 41. 4. Do not exceed 64 oz/A/year.
	2. mancozeb 75DF	3-6 lb	0.75-1.5 lb	1	77	1	
	3. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	
	4. Procure 480SC	8-16 oz	2-4 oz	12 hr	14	1	
	5. Syllit FL	4.5 pt	18 oz	2	7	1	
Grape mealybug	1. azinphos-methyl 50WP* (azinphos-methyl 50W, Guthion Solupak)	2 lb	0.5 lb	14	14-21	3	1. Do not exceed 3 applications or 6 lb/A/year. Increase PHI to 21 days if last application is over 2 lb. High rates may be damaging to predatory mites. 3. Use caution near cherry orchards due to phytotoxicity on certain cherry varieties.
	2. diazinon 50WP*	4 lb	1 lb	1	21	2	
	3. Imidan 70WP	5 lb	1.25 lb	3	7	2	

PETAL FALL CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Petal fall							
Leafrollers [#]	1. <i>Bacillus thuringiensis</i> (B.t.) (Deliver, Dipel, Javelin)	Rates vary, see label		4 hr	1	1	1. Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays usually are needed. Pink and petal fall sprays are most critical. Apply sprays 14-21 days apart. Complete coverage is necessary for good control.
	2. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1	2. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	3. Entrust 80WP	2-3 oz	0.5-0.75 oz	4 hr	7	1	3. Do not exceed 3 applications for leafroller control per year. Do not exceed 9 oz/A/year.
	4. Intrepid 2F	16 oz	4 oz	4 hr	14	1	4. Make 1-2 applications against overwintering generation larvae depending on pest pressure. Apply with spreader-sticker to increase efficacy. Do not apply more than 64 oz/A/year.
	5. Proclaim 5SG [†]	3.2-4.8 oz	0.8-1.2 oz	2	14	1	5. Do not exceed 14.4 oz/A/year. May provide pear psylla suppression at this timing.
	6. Success 2L	6-10 oz	1.5-2.5 oz	4 hr	14	1	6. Do not exceed 3 applications for leafroller control per year. Do not exceed 29 oz/A/year. Do not apply treatments less than 14 days apart.
Pear leaf-curling midge	1. azinphos-methyl 50WP* (azinphos-methyl 50W*, Guthion Solupak*)	2 lb	0.5 lb	14	14-21	3	1. Do not exceed 3 applications or 6 lb/A/year. Increase PHI to 21 days if last application is over 2 lb. High rates may be damaging to predatory mites.
	2. Calypso 4F	4-8 oz	1-2 oz	12 hr	30	2	2. Do not apply more than 16 oz/A/year.

PETAL FALL CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

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This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Petal fall							
Pear psylla and grape mealybug	1. Actara 25WDG	4.5 oz	1.1 oz	12 hr	35	2	1. Do not exceed 16.5 oz/A/year. Observe 10-day interval between applications. 2&3. Toxic to bees. Use appropriate caution. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 12-day interval between applications. 3. See remark 2 above. 4. Do not apply more than 16 oz/A/year. 5. Do not apply to bloom or when bees are present in orchard. Allow 10 days between applications.
	2. Assail 70WP	1.7-3.4 oz	0.42-0.85 oz	12 hr	7	2	
	3. Assail 30SG	4-8 oz	1-2 oz	12 hr	7	2	
	4. Calypso 4F	4-8 oz	1-2 oz	12 hr	30	2	
	5. Provado 1.6F (Other products with same ai are available.)	20 oz	5 oz	12 hr	7	2	
Pear psylla [‡] , leafrollers [‡] , and San Jose scale	1. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	45	1	1. Will provide leafroller suppression as part of a season-long program. Do not exceed 2 applications or 10 oz/A/year.
Pear psylla, spider mites [‡] , and rust mites	1. Agri-Mek 0.15EC* (Other products with same ai are available.)	16-20 oz	4-5 oz	12 hr	28	1	1. Apply in combination with oil at 0.25% of spray volume. Higher rates of oil when used in combination with Agri-Mek can mark the fruit, especially Anjou and Bartlett. Do not apply within 110 ft of aquatic areas. Alternate Agri-Mek with other available acaricides as a resistance management strategy.
	+ a. HMO	1 gal	1 qt	4 hr	—	1	

PETAL FALL CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Petal fall							
Spider mites [‡] , rust mites	1. Envidor 2SC	16-18 oz	4-4.5 oz	12 hr	7	1	1. Toxic to bees. Use appropriate caution. Do not exceed 1 application or 18 oz/A/year.
	2. Fujimite 5EC	2 pt	8 oz	12 hr	14	1	2. Toxic to fish. Use appropriate caution. Do not exceed 2 applications or 32 oz/A/year.
	3. Nexter 75WP	4.4-10.67 oz	1.1-2.6 oz	12 hr	7	1	3. Toxic to bees and fish. Use appropriate caution. Effective against European red mite and pear rust mite. Good coverage essential. Results for McDaniel and twospotted spider mites have been inconsistent. Do not exceed 1 application or 10.67 oz/A/year.
	4. Vendex 50WP	1.5-2 lb	6-8 oz	2	14	2	4. Resistance may be present in some orchards.
Spider mites [‡] only	1. Acramite 50WS	0.75-1 lb	0.19-0.25 lb	12 hr	7	1	1. One application per year.
	2. Apollo 50SC	4-8 oz	1-2 oz	12 hr	21	1	2. One application per year. Do not use any combination of Apollo, Onager, and Savey in the same growing season.
	3. Kanemite 15SC	21-31 oz	5.25-7.75 oz	12 hr	14	1	3. Toxic to aquatic organisms. Use appropriate caution. Do not exceed 2 applications or 62 oz/A/year. Observe 21-day interval between applications.
	4. Onager 1EC	16-24 oz	4-6 oz	12 hr	28	1	4. One application per year. Do not use any combination of Apollo, Onager, and Savey in the same growing season.
	5. Savey 50DF	4-6 oz	1-1.5 oz	12 hr	28	1	5. One application per year. Do not use any combination of Apollo, Onager, and Savey in the same growing season.
	6. Zeal 72WDG	2-3 oz	0.5-0.75 oz	12 hr	14	1	6. One application per year. Primarily ovicidal/larvicidal.

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
Late spring and summer cover sprays						See footnote 2, page 41.	
Aphids	1. Clutch 50WDG	2-3 oz	0.5-0.75 oz	12 hr	7	2	1. Do not exceed 6.4 oz/A/year.
Aphids and grape mealy bug	1. Actara 25WDG	4.5 oz	1.1 oz	12 hr	35	2	1. Do not exceed 16.5 oz/A/year. Observe 10-day interval between applications.
	2. Assail 70WP	1.1-1.7 oz	0.27-0.42 oz	12 hr	7	2	2&3. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 12-day interval between applications.
	3. Assail 30SG	2.5-4 oz	0.64-1 oz	12 hr	7	2	3. See remark 2 above.
	4. Calypso 4F	4-8 oz	1-2 oz	12 hr	30	2	4. Do not exceed 16 oz/A/year.
	5. Provado 1.6F (Other products with same ai are available.)	4-8 oz	1-2 oz	12 hr	7	2	5. Allow 10 days between applications.
Grape mealy bug	1. Centaur 70WDG	34.5 oz	8.62 oz	12 hr	14	1	1. Do not exceed 2 applications or 69 oz/A/year, 7-day minimum interval.
Codling moth	1. Assail 70WP	3.4 oz	0.85 oz	12 hr	7	2	1&2. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 12-day interval between applications.
	2. Assail 30SG	8 oz	2 oz	12 hr	7	2	2. See remark 1 above.
	3. Calypso 4F	4-8 oz	1-2 oz	12 hr	30	2	3. Apply first spray at start of egg laying to shortly before first egg hatch. Apply subsequent sprays at 2-week intervals. Do not exceed 16 oz/A/year.
	4. Delegate 25WG	6-7 oz	1.5-1.75 oz	4 hr	7	1	4. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.

LATE SPRING AND SUMMER COVER SPRAYS CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Late spring and summer cover sprays							
See footnote 2, page 41.							
Codling moth: these products are suppressive and are for use in low-pressure situations in conjunction with other codling moth control measures.	1. Avaunt 30WG	5-6 oz	2.5-3 oz	12 hr	28	2	1. Apply in spray volume of 200 gal/A or less. Do not apply more than 4 times/year or more than 24 oz/A/year. 2. Do not exceed 6.4 oz/A/year. 3a-c. Granulosis virus applications will cause high larval mortality but some superficial fruit damage (stings) will occur. 3-a. Rate per acre based on spray volume of 100 gal. Start at egg hatch and reapply at 10-day interval, as needed, to control larvae. 3-b. Rate per acre based on spray volume of 100 gal. Start at egg hatch and reapply at 7-day interval, as needed, to control larvae. 3-c. See label. 4. Do not exceed 9 oz/A/year. 5. Apply with spreader-sticker to increase efficacy. Do not apply more than 64 oz/A/year. See label for application timing. 6. Do not exceed 3 applications for leafroller control per year. Do not exceed 29 oz/A/year. Do not apply treatments less than 14 days apart.
	2. Clutch 50WDG	6 oz	1.5 oz	12 hr	7	2	
	3. Granulosis virus						
	a. Carpovirusine	6.8-13.5 oz	1.7-13.5 oz	4 hr	0	1	
	b. Cyd-X + Nufilm-17	3 oz 8-16 oz	3 oz 8-16 oz	4 hr	0	1	
	c. Virosoft	See label.	See label.	4 hr	0	1	
4. Entrust 80WP	2-3 oz	0.5-0.75 oz	4 hr	7	1		
5. Intrepid 2F	16 oz	4 oz	4 hr	14	1		
6. Success 2L	6-10 oz	1.5-2.5 oz	4 hr	14	1		
Codling moth, San Jose scale crawlers	1. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	45	1	1. Make application when scale crawlers first emerge. Oil improves performance. Do not exceed 2 applications or 10 oz/A/year.
Codling moth, San Jose scale crawlers, and grape mealy bug	1. azinphos-methyl 50WP* (azinphos-methyl 50W, Guthion Solupak)	1-2 lb	4-8 oz	14	14-21	3	1. Do not exceed 3 applications or 6 lb/A/year. Increase PHI to 21 days if last application is over 2 lb. High rates may be damaging to predatory mites.
	2. diazinon 50WP*	4 lb	1 lb	2	21	2	3. Use caution near cherry orchards due to phytotoxicity on certain cherry varieties.
	3. Imidan 70W	3-5 lb	0.75-1.25 lb	3	7	2	

Note: Contact your packing house for voluntary increased PHI for these materials.

LATE SPRING AND SUMMER COVER SPRAYS CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Late spring and summer cover sprays						See footnote 2, page 41.	
Leafrollers [#]	1. <i>Bacillus thuringiensis</i> (B.t.) (Deliver, Dipel, Javelin)	Rates vary, see label		4 hr	1	1	1. Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays usually are needed. Pink and petal fall sprays are most critical. Apply sprays 14-21 days apart. Complete coverage is necessary for good control.
	2. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1	2. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	3. Entrust 80WP	2-3 oz	0.5-0.75 oz	4 hr	7	1	3. Do not exceed 3 applications for leafroller control per year. Do not exceed 9 oz/A/year.
	4. Intrepid 2F	16 oz	4 oz	4 hr	14	1	4. Make 1-2 applications against summer generation larvae depending on pest pressure. Apply with spreader-sticker to increase efficacy. Do not apply more than 64 oz/A/year.
	5. Proclaim 5SG*	3.2-4.8 oz	0.8-1.2 oz	2	14	1	5. Do not exceed 14.4 oz/A/year.
	6. Success 2L	6-10 oz	1.5-2.5 oz	4 hr	14	1	6. Do not exceed 3 applications for leafroller control per year. Do not exceed 29 oz/A/year. Do not apply treatments less than 14 days apart.

LATE SPRING AND SUMMER COVER SPRAYS CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Late spring and summer cover sprays						See footnote 2, page 41.	
Pear psylla [#]	1. Actara 25WDG	5.5 oz	1.37 oz	12 hr	35	2	1. If used at cover spray timing, include a material for codling moth control. Do not exceed 16.5 oz/A/year. Observe 10-day interval between applications.
	2. Agri-Mek 0.15EC* (Other products with same ai are available.)	16-20 oz 1 gal	4-5 oz 1 qt	12 hr 4 hr	28 —	1 1	2. See above under Petal fall. Use up to second cover (late June). Effectiveness of Agri-Mek diminishes in late season. Alternate with other available insecticides for summer control of pear psylla as a resistance management strategy.
	+ a. HMO						
	3. Assail 70WP	3.4 oz	0.85 oz	12 hr	7	2	3&4. Will also control codling moth if used at appropriate timing. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 12-day interval between applications.
	4. Assail 30SG	8 oz	2 oz	12 hr	7	2	4. See remark 3 above.
	5. Calypso 4F	4-8 oz	1-2 oz	12 hr	30	2	5. Will also control codling moth if used at appropriate timing. Do not exceed 16 oz/A/year.
	6. Centaur 70WDG	34.5 oz	8.62 oz	12 hr	14	1	6. Do not exceed 2 applications or 69 oz/A/year, 7-day minimum interval.
	7. Clutch 50WDG	4-6 oz	1-1.5 oz	12 hr	7	2	7. Do not exceed 6.4 oz/A/year.
	8. Fujimite 5EC	2 pt	8 oz	12 hr	14	1	8. Toxic to fish. Use appropriate caution. Do not exceed 2 applications or 32 oz/A/year.
	9. Nexter 75WP	7.0-10.67 oz	1.7-2.6 oz	12 hr	7	1	9. Toxic to bees and fish. Use appropriate caution. Do not exceed 1 application or 10.67 oz/A/year.
	10. Provado 1.6F (Other products with same ai are available.)	20 oz	5 oz	12 hr	7	2	10. Allow 10 days between applications.

LATE SPRING AND SUMMER COVER SPRAYS CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Late spring and summer cover sprays						See footnote 2, page 41.	
Spider mites [#] and rust mites	1. Agri-Mek 0.15EC* (Other products with same ai are available.)	10 oz	2.5 oz	12 hr	28	1	1. See above under Petal fall. Use up to second cover (late June). Effectiveness of Agri-Mek diminishes in late season.
		1 gal	1 qt	4 hr	—	1	
	+ a. HMO						
	2. Envior 2SC	16-18 oz	4-4.5 oz	12 hr	7	1	2. Do not exceed 1 application or 18 oz/A/year.
	3. Fujimite 5EC	2 pt	8 oz	12 hr	14	1	3. Toxic to fish. Use appropriate caution. Do not exceed 2 applications or 32 oz/A/year.
	4. Nexter 75WP	4.4-10.67 oz	1.1-2.6 oz	12 hr	7	1	4. Toxic to bees and fish. Use appropriate caution. Effective against European red mite and pear rust mite. Good coverage essential. Results for McDaniel and twospotted spider mites have been inconsistent. Do not exceed 1 application or 10.67 oz/A/year.
	5. Vendex 50WP	1.5-2 lb	6-8 oz	2	14	2	5. Resistance may be present in some orchards.
	6. Vydate 2L†*	3-4 qt	24-32 oz	2	14	3	
Rust mites only	1. carbaryl 50WP†	6 lb	1.5 lb	12 hr	1	2	1. Do not use HMO within 30 days of carbaryl or vice-versa.
	2. Kelthane 50WP†	3-4 lb	0.75-1 lb	2	7	2	
Spider mites [#] only	1. Acramite 50WS	0.75-1 lb	0.19-0.25 lb	12 hr	7	1	1. One application per year.
	2. Apollo 50SC	4-8 oz	1-2 oz	12 hr	21	1	
	3. Kanemite 15SC	21-31 oz	5.25-7.75 oz	12 hr	14	1	3. Toxic to aquatic organisms. Use appropriate caution. Do not exceed 2 applications or 62 oz/A/year. Observe 21-day interval between applications.
	4. Onager 1EC	16-24 oz	4-6 oz	12 hr	28	1	4. One application per year. Do not use any combination of Apollo, Onager, and Savey in same growing season.
	5. Savey 50DF	4-6 oz	1-1.5 oz	12 hr	28	1	5. One application per year. Do not use any combination of Apollo, Onager, and Savey in same growing season.
	6. Zeal 72WDG	2-3 oz	0.5-0.75 oz	12 hr	14	1	6. One application per year. Primarily ovicidal/larvicidal.

LATE SPRING AND SUMMER COVER SPRAYS CONTINUED ON NEXT PAGE

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for pears (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Late spring and summer cover sprays						See footnote 2, page 41.	
Stink bugs	1. endosulfan (Thionex 50W*)	4-5 lb	1-1.25 lb	4	7	3	1. Do not exceed 2 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies.
Preharvest							
Storage rots	1. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	1. Do not exceed 4 applications per year. See footnote 6, page 41.
	2. Topsin M	1 lb	0.25 lb	3	1	2	2. See footnote 7, page 41
	3. ziram 76DF	6-8 lb	1.5-2 lb	2	5	2	3. See footnote 3, page 41.
<p>Note: Nutra-phos 24 applied prior to harvest as a foliar nutrient (15 lb/acre; 3.75 lb/100 gal) has shown significant incidental reductions in blue mold in Anjou pears. Nutra-phos 24 is not a pesticide; therefore, we cannot recommend its use for storage rot control.</p> <p>Contact your packing house before choosing one of these materials.</p>							
Postharvest, September 15–October 15							
Rust mites, blister mites	1. HMO	3-4 gal	0.75-1 gal	4 hr	—	1	a, b, c. Widespread use (>80% of area) of postharvest oil plus sulfur sprays will result in area-wide suppression of overwintering pear psylla populations. Sulfur sprays are most effective when applied at temperatures above 60°F.
	+ a. dry flowable sulfur	15-20 lb	3.75-5 lb	1	—	1	
	b. flowable sulfurs	1-2 gal	1-2 qt	1	—	1	
	c. lime sulfur	10 gal	2.5 gal	2	—	1	

† These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

** Pear psylla has developed resistance to pyrethroid insecticides. Control at recommended rates has been poor in some orchards in the Mid-Columbia area. Use pyrethroid insecticides conservatively to maintain effectiveness as long as possible.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

FOOTNOTES (Spray tips and cautions)

1. Lime sulfur may be used for scab and mildew control on Bosc and Bartlett pears if a lime sulfur and oil dormant spray was applied and if temperatures remain below 90°F. Do not use lime sulfur on Anjou and Comice pears between the dormant and postharvest sprays.

It should be recognized that although lime sulfur and other sulfur materials are relatively low in cost, they are not without limitations. The use of sulfurs may result in phytotoxicity when temperatures exceed 90°F following application. Below 50°F, the action of sulfur is greatly reduced.

2. Use caution when mixing wettable powders with emulsifiable materials. Certain combinations may not be physically compatible and/or may cause phytotoxicity.

3. Ziram may cause irritation of eyes, nose, throat, and skin.

4. Do not combine the 6-lb prebloom or 3-lb all-season mancozeb or Polyram schedule. See labels for details. There are several manufacturers of mancozeb with different trade names and formulations, such as Dithane M-45, Manzate 75DF, and Penncozeb 75DF.

5. Do not use copper-based products on Anjou, Comice, or Forelle past delayed dormant. Fixed copper products include trade names such as Champ, C-O-C-S, Copper-Count-N, Cuprofix Disperss, Kocide, Nordox, and Nu-Cop.

6. Do not exceed 4 total applications per season of any Qol fungicide or any combination of these fungicides such as Flint or Pristine.

7. The resistance risk of Topsin is considered high. We suggest using alternative products this year if Topsin was used last year for management of storage rots.

Relative efficacy guide for pesticides used on pear—prebloom

This table is intended as a guideline to the relative efficacy of pesticides against a certain pest. Use it in conjunction with the Pest Control Program for Pears, which gives recommended rates and timing of sprays. The information in this table is based on research conducted at the WSU Wenatchee Tree Fruit Research and Extension Center and at the OSU Mid-Columbia Agricultural Research and Extension Center. Susceptibility may vary from one area to another.

Common name	Trade name	Rate/acre	Pests												
			PP	CM	GMB	SJS	GAA	ERM	PRM	TSM	THR	LEP	SB	LB	LR
Carbamates															
carbaryl	Sevin 50WP	4 lb	-	-	-	-	-	-	3	-	-	-	-	-	-
oxamyl	Vydate 2L	3-4 pt	-	-	-	-	-	2	x	2-3	-	-	-	-	-
Insect growth regulators															
diflubenzuron	Dimilin 2L	2.5-3 pt	3	-	-	-	-	-	x	-	-	-	-	-	-
methoxyfenozide	Intrepid 2F	8-16 oz	-	-	-	-	-	-	-	-	x	-	-	-	3-4
pyriproxyfen	Esteem 35WP	4-5 oz	3	-	-	3-4	-	-	-	-	-	-	-	-	3
Neonicotinoids															
acetamiprid	Assail 70WP	1-3.4 oz	3-4	-	x	-	-	-	-	-	-	-	x	x	-
clothianidin	Clutch 50WDG	3-6 oz	3-4	-	x	x	3-4	-	-	-	-	-	x	x	-
thiamethoxam	Actara 25WDG	4.5 oz	3-4	-	x	-	3-4	-	-	-	-	-	x	x	-
Organochlorines															
endosulfan	Thionex 3EC	3.33 qt	3-4	-	-	-	1	-	4	-	3-4	3-4 ^a	2-3	2-3	2
Organophosphates															
azinphos-methyl	Guthion 50WP	2 lb	-	-	3-4	x	x	-	-	-	-	4	x	x	-
chlorpyrifos	Lorsban 4E	4 pt	-	-	3-4	x	x	-	-	-	-	4	x	x	3-4
oil + chlorpyrifos	oil + Lorsban 4E	6 gal + 2 qt	2-3	-	3	4	3	3-4	x	-	-	2	2-3	2-3	3-4
oil + diazinon	oil + diazinon 50WP	6 gal + 5 lb	2-3	-	3	4	3	3	2	-	-	2	2-3	2-3	x
methidathion	Supracide 2E	1 gal	-	-	3	4	x	-	-	-	-	2	x	-	-
Pyrethroids															
deltamethrin	Battalion 0.2EC	7-14.1 oz	1-4 ^b	-	-	-	-	-	-	-	-	4	4	4	x
esfenvalerate	Asana 0.66EC	1 pt	1-4 ^b	-	-	-	-	-	-	-	x	x	4	4	x
fenpropathrin	Danitol 2.4EC	16-21.3 oz	1-4 ^b	-	-	-	-	-	-	-	x	x	4	4	x
lambda-cyhalothrin	Warrior 1SC	2.56-5.12 oz	1-4 ^b	-	-	-	-	-	-	-	-	4	4	4	x
permethrin	Pounce 3.2EC	12 oz	1-4 ^b	-	-	-	-	-	-	-	x	4	4	4	x
Pyridazinones															
pyridaben	Nexter 75WP	7 oz	3-4	-	1-2	-	-	4	3	2-4	x	-	x	x	-
Others															
<i>Bacillus thuringiensis</i>	Deliver, Dipel, Javelin	1-2 lb	-	-	-	-	-	-	-	-	-	-	-	-	3-4
HMO (horticultural mineral oil)		4-6 gal	2-3	-	-	3	-	3-4	x	-	-	-	-	-	x
kaolin	Surround	50 lb	3-4	-	x	-	x	-	x	-	x	x	-	-	3
spinosad	Success 2L	6-10 oz	-	-	-	-	x	-	x	-	3-4	x	-	-	4
spiroticlofen	Envidor 2SC	16-18 oz	-	-	-	-	-	4	4	4	-	-	-	-	-

Rating system: 4=excellent control; 3=acceptable in low-pressure situations; 2=suppression activity only; 1=poor control; - = inappropriate for this pest or at this time; x=no data available.

^aRate per 100 gallons (cutworm spray); use as a trunk spray.

^bResistance is present in many areas.

PP=Pear psylla; CM=Codling moth; GMB=Grape mealybug; SJS=San Jose scale; GAA=Green apple aphid; ERM=European red mite; PRM=Pear rust mite; TSM=Twospotted spider mite and McDaniel spider mite; THR=Thrips; LEP=Cutworm, Armyworm, and Fall webworm; SB=Stink bug; LB=Lygus bug; LR=Leafroller.

Relative efficacy guide for pesticides used on pear—postbloom

This table is a guideline to the relative efficacy of pesticides against a certain pest. Use it in conjunction with the Pest Control Program for Pears. Table is based on research at the WSU Wenatchee Tree Fruit Research and Extension Center and the OSU Mid-Columbia Agricultural Research and Extension Center. Susceptibility may vary from one area to another.

Common name	Trade name	Rate/acre	Pests														
			PP	CM	GMB	SJS	GAA	ERM	PRM	TSM	THR	LEP	SB	LB	LR		
Carbamates																	
carbaryl	Sevin 50WP	4 lb	–	2	x	1	1	–	3	–	–	x	1	1	–	–	
formetanate hydrochloride	Carzol 92SP	1 lb	1	x	x	x	x	3	3-4	2	4	x	3	3	–	–	
oxamyl	Vydate 2L	3-4 pt	1	x	x	x	x	2	x	2-3	–	x	x	x	–	–	
Carboxamides																	
hexythiazox	Savey 50DF	3-6 oz	–	–	–	–	–	2-4 ^a	–	2-4	–	–	–	–	–	–	
	Onager 1 EC	16-24 oz	–	–	–	–	–	2-4 ^a	–	2-4	–	–	–	–	–	–	
Carboxylic acid esters																	
bifenazate	Acramite 50WS	0.75-1 lb	–	–	–	–	–	3-4	–	–	–	–	–	–	x	x	
Glycosides																	
abamectin	Agri-Mek 0.15EC	5-20 oz	3-4	–	–	–	–	4	4	3-4	–	–	–	–	–	–	
emamectin benzoate	Proclaim 5SG	3.2-4.8 oz	x	x	–	–	–	–	–	–	–	3	–	–	–	3-4	
Insect growth regulators																	
buprofezin	Centaur 70WDG	34.5 oz	3	–	3-4	3-4	–	–	–	–	–	–	–	–	–	–	
diflubenzuron	Dimilin 2L	12-16 oz	2	1-3 ^b	–	–	–	–	x	–	–	–	–	–	–	–	
methoxyfenozide	Intrepid 2F	16 oz	–	3	–	–	–	–	–	–	–	–	–	–	x	3-4	
pyriproxyfen	Esteem 35WP	4-5 oz	3	3	x	3-4	–	–	–	–	–	–	–	–	–	3	
Microbials																	
<i>Bacillus thuringiensis</i>	Deliver, Dipel, Javelin	varies	–	–	–	–	–	–	–	–	–	x	–	–	–	3-4	
codling moth granulosis virus	Carpovirusine	13.5 oz	–	2-3	–	–	–	–	–	–	–	–	–	–	–	–	
	Cyd-X	3 oz	–	2-3	–	–	–	–	–	–	–	–	–	–	–	–	
	Virosoft	8 oz	–	2-3	–	–	–	–	–	–	–	–	–	–	–	–	
Neonicotinoids																	
acetamiprid	Assail 70WP	1-3.4 oz	3-4	3-4	3	–	3-4	–	–	–	–	–	–	x	x	–	
clothianidin	Clutch 50WDG	3-6 oz	3-4	2-3	x	x	4	–	–	–	–	–	x	x	x	x	
imidacloprid	Provado 1.6F	15-20 oz	3-4	–	3-4	x	3-4	–	–	–	–	–	–	–	–	–	
	Couraze 1.6F	15-20 oz	3-4	–	3-4	x	3-4	–	–	–	–	–	–	–	–	–	
thiacloprid	Calypso 4F	2-8 oz	3-4	3-4	x	x	3-4	–	–	–	–	–	–	–	–	–	
thiamethoxam	Actara 25WDG	4.5 oz	3-4	–	3-4	x	3-4	–	–	–	–	–	x	x	–	–	
Organochlorines																	
dicofol	Kelthane 50WP	4 lb	–	–	–	–	–	–	3	1-3 ^b	–	–	–	–	–	–	
endosulfan	Thionex 50W	2.5 lb	1	1	–	1	2	–	1-3	–	3-4	3-4	2-3	2-3	–	–	
Organophosphates																	
azinphos-methyl	Guthion 50WP	1-2 lb	1	4	3-4	2	1	–	–	–	–	x	x	x	2-3	–	
diazinon	Diazinon 50WP	4 lb	–	2	3-4	3	2-3	–	–	–	–	x	3	3	–	–	
dimethoate	Dimethoate 2.67EC	4 pt	–	2	x	x	2-3	–	–	–	–	x	3-4	3-4	–	–	
phosmet	Imidan 70WP	3-5 lb	–	3-4	3-4	2	2	–	–	–	–	x	x	x	–	–	
Organotins																	
fenbutatin oxide	Vendex 50WP	1.5-2 lb	–	–	–	–	–	1-4	2-4	2-4	–	–	–	–	–	–	
Oxadiazines																	
indoxacarb	Avaunt 30WG	5-6 oz	–	2-3	–	–	–	–	–	–	–	–	–	–	–	–	
Pyrethroids																	
deltamethrin	Battalion 0.2EC	7-14.1 oz	x	3-4	x	x	x	–	–	–	x	4	4	4	x	–	
fenpropathrin	Danitol 2.4EC	20 oz	x	3-4	x	x	x	x	x	x	x	x	4	4	4	x	
lambdacyhalothrin	Warrior 1SC	2.56-5.12 oz	x	3-4	x	x	x	–	–	–	x	4	4	4	x	–	
Pyridazinones																	
fenpyroximate	Fujimite 5EC	16 oz	x	–	x	–	–	4	3-4	3	–	–	–	–	–	–	
pyridaben	Nexter 75WP	4.4-10.67 oz	3-4	–	x	–	–	4	3	2-3	–	–	–	–	–	–	
Quinoline																	
acequinocyl	Kanemite 15SC	21-31 oz	–	–	–	–	–	4	x	4	–	–	–	–	–	–	
Tetrazines																	
clofentezine	Apollo 50SC	4-8 oz	–	–	–	–	–	2-4	1	2-4	–	–	–	–	–	–	
Others																	
etoxazole	Zeal 72WDG	2-3 oz	–	–	–	–	–	3-4	–	3-4	–	–	–	–	–	–	
kaolin	Surround	50 lb	3-4	3	x	x	x	1-2	1-2	1-2	–	–	x	x	x	x	
spinosad	Entrust 80WP	2-3 oz	–	2-3	–	–	–	–	–	–	–	3-4	–	–	–	4	
	Success 2L	6-10 oz	–	2-3	–	–	–	–	–	–	–	3-4	–	–	–	4	
spirodiclofen	Envidor 2SC	16-18 oz	x	x	x	x	x	3-4	3-4	3-4	x	x	x	x	x	x	

4=excellent control; 3=acceptable in low-pressure situations; 2=suppression only; 1=poor control; – = inappropriate for this pest or at this time; x=no data available.

^aRecommended for prebloom use.

^bRate per 100 gallons (cutworm spray); use as a trunk spray.

PP=Pear psylla; CM=Codling moth; GMB=Grape mealybug; SJS=San Jose scale; GAA=Green apple aphid; ERM=European red mite; PRM=Pear rust mite; TSM=Twospotted spider mite and McDaniel spider mite; THR=Thrips; LEP=Cutworm, Armyworm, and Fall webworm; SB=Stink bug; LB=Lygus bug; LR = Leafroller.

Effectiveness of fungicides and bactericides for control of pear diseases*

Jay W. Pscheidt, Bob Spotts, and David Sugar, Oregon State University

Fungicide or bactericide	Family	Pear scab	Powdery mildew	Bull's eye rot	Storage rots	Fire blight
Blight Ban	Biological	???	???	???	???	Fair
copper-based products	Inorganic	???	Fair???	Poor	???	Fair
Flint	QoI	Excellent**	Excellent**	Good	???	None
horticultural mineral oils	Oil	???	Good	???	???	None
lime sulfur	Inorganic	Good	Fair	???	???	None
mancozeb products	EBDC	Excellent	None	Poor	???	None
Pristine	QoI + boscalid	Good-excellent**	Excellent	Good	Fair-good	None
Procure	DMI	Good**	Excellent**	???	???	None
Rubigan	DMI	Good**	Excellent**	???	???	None
Scala	Anilino-pyrimidine	Fair-good	None	???	???	None
streptomycin	Antibiotic	None	None	None	None	Fair-good**
sulfur	Inorganic	Fair	Good	???	???	None
Syllit	Guanidine	Excellent**	None	???	???	None
terramycin	Antibiotic	None	None	None	None	Fair-good**
Topsin M	Benzimidazole	Good	Good**	Excellent	Good	None
Ziram	EBDC-like	Fair	None	Good	Fair-good	None

*These ratings are relative rankings based on full application rates, good spray coverage, and proper spray timing. Actual levels of disease control will be influenced by these factors in addition to cultivar susceptibility, disease pressure, and weather conditions. Possible ratings for disease control include none, poor, fair, good or excellent.

**Resistant pathogens will lower the effectiveness of this fungicide.

2008 Mid-Columbia pest control program for apples

Application rates in the tables are for dilute sprays, estimated as 400 gallons per acre. Gallonage requirements vary depending on tree size, shape, and spray equipment. Large, heavily barked trees infested with scale insects may need to be sprayed with more than 400 gallons of spray solution per acre, but never exceed the labeled rate per acre. Base CONCENTRATE SPRAYS on the amount of formulation given per acre unless indicated otherwise on a product's label.

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. **MATERIALS ARE LISTED ALPHABETICALLY.**

Integrated Fruit Production (IFP) is "the economical production of high-quality fruit which gives priority to ecologically sound methods and minimizes side effects and use of agricultural chemicals, thereby protecting the environment and human health."

IFP preference rankings were established for pesticides and herbicides registered for pears and apples. Most-preferred materials are given a #1, materials with lower preference (intermediate) are designated #2, and least preferred but permitted materials are listed as #3. The leaching potential, soil sorption, material toxicity, efficacy, preharvest interval, soil half-life, effects on beneficials, and biological disruption of each material were considered when drawing up the ranking list.

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
Delayed dormant (Stages 2 and 3)						See footnotes 1 and 3, page 60.	
European red mite eggs, scale, aphids, leafrollers [#]	1. horticultural mineral oil (HMO)	4-8 gal	1-2 gal	4 hr	—	1	
	2. HMO +	4-8 gal	1-2 gal	4 hr	—	1	
	a. diazinon 50WP*	3-4 lb	12-16 oz	2	—	2	
	b. lime sulfur	5-10 gal	1.25-2.5 gal	2	—	1	b. See footnote 1, page 60. Lime sulfur plus oil will not control leafrollers.
	c. Lorsban 4E*	4 pt	1 pt	4	prebloom	2	c. Apply at stage 3 for control of leafrollers.
d. Supracide 2E†*	3-12 pt	1-2 pt	2-14	prebloom	3	d. Increase REI to 14 days if application is over 8 pt per acre.	
European red mite eggs	1. Apollo 50SC	4-8 oz	1-2 oz	12 hr	45	1	1, 2, 3. One application per year. Do not use any combination of Apollo, Onager, and Savey in same growing season.
	2. Onager 1EC	12-24 oz	3-6 oz	12 hr	28	1	
	3. Savey 50DF	3-6 oz	0.75-1.5 oz	12 hr	28	1	
San Jose scale and leafrollers [#]	1. HMO	4-6 gal	1-1.5 gal	4 hr	—	1	
	+ a. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	45	1	a. Do not exceed 2 applications or 10 oz/A/year.
Crown and collar rot (rare)	1. Ridomil Gold EC	NA	0.5 pt	2	—	—	1. Rate based on tree size. Have rain or irrigation move material into root zone. Labeled as a soil drench.

See also postharvest controls on page 60.

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
Prepink (Stages 4 and 5)							
Powdery mildew See footnote 1, page 60	1. Flint 50WG	2-2.5 oz	0.5-0.62 oz	12 hr	14	1	1. Do not exceed 4 applications per year. See footnote 9, page 60. 2. Do not exceed 4 applications per year. See footnote 9, page 60. 3. Do not exceed 64 oz/A/year. 4. Do not apply more than 5 lb/A/year. See footnote 10, page 60.
	2. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	
	3. Procure 480SC	8-16 oz	2-4 oz	12 hr	14	1	
	4. Rally 40W	5-10 oz	1.25-2.5 oz	1	14	1	
Scab See footnote 1, page 60	1. Flint 50WG	2-2.5 oz	0.5-0.62 oz	12 hr	14	1	1. Do not exceed 4 applications per year. See footnotes 8 and 9, page 60. 2. Do not apply more than 21 lb/A/year at 3 lb rate or 24 lb/A/year at 6 lb rate. See footnote 7, page 60. 3. Do not exceed 4 applications per year. See footnotes 8 and 9, page 60. 4. Do not exceed 64 oz/A/year. 5. Do not apply more than 5 lb/A/year. 6. See footnotes 2 and 6, page 60. 7. Do not apply more than 32 lb/A/year. See footnote 5, page 60.
	2. mancozeb 75DF	3-6 lb	0.75-1.5 lb	1	77	1	
	3. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	
	4. Procure 480SC	8-16 oz	2-4 oz	12 hr	14	1	
	5. Rally 40W	5 oz	1.25 oz	1	14	1	
	6. Syllit FL	1.5-4.5 pt	6-18 oz	2	7	1	
	7. ziram 76DF	6-8 lb	1.5-2 lb	2	14	1	
Green fruit worm, leafrollers**	1. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1	1. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year. 2. Do not exceed 3 applications for leafroller control per year. Do not exceed 9 oz/A/year. 3. Do not exceed 3 applications for leafroller control per year. Do not exceed 29 oz/A/year. Do not apply treatments less than 14 days apart.
	2. Entrust 80WP	2-3 oz	0.5-0.75 oz	4 hr	7	1	
	3. Success 2L	6-10 oz	1.5-2.5 oz	4 hr	7	1	
Green fruit worm, leafrollers***, rosy apple aphid, sucking bugs	1. diazinon 50WP*	4 lb	1 lb	2	14	2	2. Toxic to bees. Use appropriate caution. Do not exceed 3 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies. 3. For prebloom only. 4. Toxic to bees. Use appropriate caution. Do not exceed 14.4 oz/A/year.
	2. endosulfan (Thionex 50W*)	4 lb	1 lb	4	21	3	
	3. Lorsban 50W†*	3 lb	12 oz	4	prebloom	2	
	4. Proclaim 5SG*	3.2-4.8 oz	0.8-1.2 oz	2	14	1	

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
Pink (Stages 6 and 7)							
Powdery mildew See footnote 1, page 60	1. Flint 50WG	2-2.5 oz	0.5-0.62 oz	12 hr	14	1	1. Do not exceed 4 applications per year. See footnote 9, page 60.
	2. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	2. Do not exceed 4 applications per year. See footnote 9, page 60.
	3. Procure 480SC	8-16 oz	2-4 oz	12 hr	14	1	3. Do not exceed 64 oz/A/year.
	4. Rally 40W	5-10 oz	1.25-2.5 oz	1	14	1	4. Do not apply more than 5 lb/A/year. See footnote 10, page 60.
Scab See footnote 1, page 60	1. Flint 50WG	2-2.5 oz	0.5-0.62 oz	12 hr	14	1	1. Do not exceed 4 applications per year. See footnotes 8 and 9, page 60.
	2. mancozeb 75DF	3-6 lb	0.75-1.5 lb	1	77	1	2. Do not apply more than 21 lb/A/year at 3-lb rate or 24 lb/A/year at 6-lb rate. See footnote 7, page 60.
	3. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	3. Do not exceed 4 applications per year. See footnotes 8 and 9, page 60.
	4. Procure 480SC	8-16 oz	2-4 oz	12 hr	14	1	4. Do not exceed 64 oz/A/year.
	5. Rally 40W	5 oz	1.25 oz	1	14	1	5. Do not apply more than 5 lb/A/year.
	6. Syllit FL	1.5-4.5 pt	6-18 oz	2	7	1	6. See footnotes 2 and 6, page 60.
	7. ziram 76DF	6-8 lb	1.5-2 lb	2	14	1	7. Do not apply more than 32 lb/A/year. See footnote 5, page 60.
Aphids	1. Assail 70WP	1.1-1.7 oz	0.27-0.42 oz	12 hr	7	2	1&2. Toxic to bees. Use appropriate caution. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 12-day interval between applications.
	2. Assail 30SG	2.5-4 oz	0.64-1 oz	12 hr	7	2	2. See remark 1 above.
	3. Calypso 4F	2-4 oz	0.5-1 oz	12 hr	30	2	3. Do not exceed 16 oz/A/year.
	4. endosulfan (Thionex 50W*)	4 lb	1 lb	4	21	3	4. Resistance has been detected. Toxic to bees. Use appropriate caution. Do not exceed 3 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies.

PINK CONTINUED ON NEXT PAGE

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED —Pink (Stages 6 and 7)							
Codling moth	1. Checkmate CM-XL 1000	120-200 ties	NA	—	0	1	1, 2, 3, 4. Other products are available, but experience is limited with those products. If pest pressure is high, combine with one or more insecticides against the first generation. Treat with insecticides against the second generation if pressure remains high. If lower application rates are used, supplemental treatment with insecticides may be necessary.
	2. Isomate-C Plus	400 ties	NA	—	0	1	
	3. Isomate-CTT	200 ties	NA	—	0	1	
	4. Nomate CM	300-400 ties	NA	—	0	1	
Leafrollers [#]	1. <i>Bacillus thuringiensis</i> (B.t.) (Deliver, Dipel, Javelin)	Rates vary, see label	—	4 hr	1	1	1. Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays usually are needed. Pink and petal fall sprays are most critical. Apply sprays 14-21 days apart. Complete coverage is necessary for good control.
	2. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1	2. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	3. Entrust 80WP	2-3 oz	0.5-0.75 oz	4 hr	7	1	3. Do not exceed 3 applications for leafroller control per year. Do not exceed 9 oz/A/year.**
	4. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	45	1	4. Do not exceed 2 applications or 10 oz/A/year.
	5. Intrepid 2F	16 oz	4 oz	4 hr	14	1	5. Make 1-2 applications against overwintering larvae depending on pest pressure. Apply with spreader-sticker to increase efficacy. Do not apply more than 64 oz/A/year.
	6. Proclaim 5SG*	3.2-4.8 oz	0.8-1.2 oz	2	14	1	6. Toxic to bees. Use appropriate caution. Do not exceed 14.4 oz/A/year.
	7. Success 2L	6-10 oz	1.5-2.5 oz	4 hr	7	1	7. Do not exceed 3 applications for leafroller control per year. Do not exceed 29 oz/A/year. Do not apply treatments less than 14 days apart.**

PINK CONTINUED ON NEXT PAGE

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED —Pink (Stages 6 and 7)							
Mites [#]	1. Apollo 50SC	4-8 oz	1-2 oz	12 hr	45	1	1. One application per year. Do not use any combination of Apollo, Onager, and Savey in same growing season. Will not control rust mites.
	2. Envidor 2SC	16-18 oz	4-4.5 oz	12 hr	7	1	2. Do not exceed 1 application or 18 oz/A/year.
	3. Fujimite 5EC	2 pt	8 oz	12 hr	14	1	3. Toxic to fish. Use appropriate caution. Do not exceed 2 applications or 32 oz/A/year.
	4. Kanemite 15SC	21-31 oz	5.25-7.75 oz	12 hr	14	1	4. Will not control rust mites. Toxic to aquatic organisms. Use appropriate caution. Do not exceed 2 applications or 62 oz/A/year. Observe 21-day interval between applications.
	5. Onager 1EC	16-24 oz	4-6 oz	12 hr	28	1	5. One application per year. Do not use any combination of Apollo, Onager, and Savey in same growing season. Will not control rust mites.
	6. Savey 50DF	3-6 oz	0.75-1.5 oz	12 hr	28	1	6. One application per year. Do not use any combination of Apollo, Onager, and Savey in same growing season. Will not control rust mites.
	7. Vendex 50WP	1.5-2 lb	6-8 oz	2	14	2	7. Resistance may be present in some orchards.
	8. Zeal 72WDG	2-3 oz	0.5-0.75 oz	12 hr	14	1	8. Will not control rust mites. Primarily ovicidal/larvicidal. Only 1 application/year.
San Jose scale	1. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	45	1	1. Do not exceed 2 applications or 10 oz/A/year.

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
Bloom							
Fireblight	1. BlightBan A506	5-7 oz	See remarks.	4 hr	—	—	1, 2, 3. For best results, use predictive model (Cougarblight) to time applications. 1. Use the 5-oz rate in 50-150 GPA and the 7-oz rate in 200-300 GPA. Use at 20% and again at 50% bloom. Works best at the beginning of an infection period. Do not use with terramycin or copper-based products. Must be integrated with other fireblight control tactics. The addition of chelated iron as Sequestrene 138 at 1 lb/100 gal water in a tank mix with Blightban improves disease control over BlightBan alone. This is a safe and legal use; however, it would remove the registrant from any legal/financial responsibility. Do not use straight iron sulfate in the tank mix as that use will burn flowers and russet fruit.
	2. Streptomycin (Agrimycin 17, Bac-Master, Firewall, Farmsaver Agricultural Streptomycin, etc.)	Depends on formulation, see label	See remarks.	12 hr	50	1	2. Do not exceed 1 lb per 100 gal of water. Two-year shelf life.
	3. Terramycin (Mycoshield, FlameOut)	0.5-1 lb	See remarks.	12 hr	60	1	3. Apply terramycin 17% at the rate of 8 oz in 50 gal or 16 oz in 100 gal of water. Do not use higher gallonages because the effectiveness of terramycin is reduced.

NOTE: Extensive resistance to streptomycin has been found throughout the Mid-Columbia area.

Early through full bloom

Thrips	1. Carzol 92SP†*	1 lb	4 oz	4-16	7	3	1, 2. Minimize bee hazard by spraying before bees are placed in the orchard. Apply late evening or at night.
	2. endosulfan (Thionex 50W*)	3 lb	0.75 lb	4	21	3	2. Toxic to bees. Use appropriate caution. Do not exceed 3 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies.

EARLY THROUGH FULL BLOOM CONTINUED ON NEXT PAGE

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Early through full bloom							
Leafrollers*** and thrips	1. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1	1. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	2. Entrust 80WP	2-3 oz	0.5-0.75 oz	4 hr	7	1	2. Do not exceed 3 applications for leafroller control per year. Do not exceed 9 oz/A/year.
	3. Success 2L	6-10 oz	1.5-2.5 oz	4 hr	7	1	3. Do not exceed 3 applications for leafroller control per year. Do not exceed 29 oz/A/year. Do not apply treatments less than 14 days apart.
Petal fall							
Powdery mildew See footnote 1, page 60	1. Flint 50WG	2-2.5 oz	0.5-0.62 oz	12 hr	14	1	1. Do not exceed 4 applications per year. See footnote 9, page 60.
	2. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	2. Do not exceed 4 applications per year. See footnote 9, page 60.
	3. Procure 480SC	8-16 oz	2-4 oz	12 hr	14	1	3. Do not exceed 64 oz/A/year.
	4. Rally 40W	5-10 oz	1.25-2.5 oz	1	14	1	4. Do not apply more than 5 lb/A/year. See footnote 10, page 60.
Scab See footnote 1, page 60	1. Flint 50WG	2-2.5 oz	0.5-0.62 oz	12 hr	14	1	1. Do not exceed 4 applications per year. See footnotes 8 and 9, page 60.
	2. mancozeb 75DF	3 lb	0.75 lb	1	77	1	2. Do not apply more than 21 lb/A/year. See footnote 7, page 60.
	3. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	3. Do not exceed 4 applications per year. See footnotes 8 and 9, page 60.
	4. Procure 480SC	8-16 oz	2-4 oz	12 hr	14	1	4. Do not exceed 64 oz/A/year.
	5. Rally 40W	5 oz	1.25 oz	1	14	1	5. Do not apply more than 5 lb/A/year.
	6. Syllit FL	1.5-4.5 pt	6-18 oz	2	7	1	6. See footnotes 2 and 6, page 60.
	7. ziram 76DF	6-8 lb	1.5-2 lb	2	14	1	7. Do not apply more than 32 lb/A/year. See footnote 5, page 60.

PETAL FALL CONTINUED ON NEXT PAGE

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Petal fall							
Leafrollers [#]	1. <i>Bacillus thuringiensis</i> (B.t.) (Deliver, Dipel, Javelin)	Rates vary, see label		4 hr	1	1	1. Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays usually are needed. Pink and petal fall sprays are most critical. Apply sprays 14-21 days apart. Complete coverage is necessary for good control.
	2. Intrepid 2F	16 oz	4 oz	4 hr	14	1	2. Make 1-2 applications against overwintering larvae depending on pest pressure. Apply with spreader-sticker to increase efficacy. Do not apply more than 64 oz/A/year.
	3. Proclaim 5SG*	3.2-4.8 oz	0.8-1.2 oz	2	14	1	3. Toxic to bees. Use appropriate caution. Do not exceed 14.4 oz/A/year.
Leafrollers ^{***#} and tentiform leafminer [#]	1. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1	1. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	2. Entrust 80WP	2-3 oz	0.5-0.75 oz	4 hr	7	1	2. Do not exceed 3 applications for leafroller control per year. Do not exceed 9 oz/A/year.
	3. Proclaim 5SG*	3.2-4.8 oz	0.8-1.2 oz	2	14	1	3. Toxic to bees. Use appropriate caution. Do not exceed 14.4 oz/A/year.
	4. Success 2L	4-10 oz	1-3.3 oz	4 hr	7	1	4. Do not exceed 3 applications for leafroller control per year. Do not exceed 29 oz/A/year. Do not apply treatments less than 14 days apart.
Leafrollers [#] , San Jose scale, tentiform leafminer [#]	1. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	45	1	1. Do not exceed 2 applications or 10 oz/A/year.
Ten days to two weeks after petal fall							
Powdery mildew See footnote 1, page 60	1. Flint 50WG	2-2.5 oz	0.5-0.62 oz	12 hr	14	1	1. Do not exceed 4 applications per year. See footnote 9, page 60.
	2. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	2. Do not exceed 4 applications per year. See footnote 9, page 60.
	3. Procure 480SC	8-16 oz	2-4 oz	12 hr	14	1	3. Do not exceed 64 oz/A/year.
	4. Rally 40W	5-10 oz	1.25-2.5 oz	1	14	1	4. Do not apply more than 5 lb/A/year. See footnote 10, page 60.

TEN DAYS TO TWO WEEKS AFTER PETAL FALL CONTINUED ON NEXT PAGE

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED— Ten days to two weeks after petal fall							
Scab See footnote 1, page 60	1. Flint 50WG	2-2.5 oz	0.5-0.62 oz	12 hr	14	1	1. Do not exceed 4 applications per year. See footnotes 8 and 9, page 60. 2. Do not apply more than 21 lb/A/year. See footnote 7, page 60. 3. Do not exceed 4 applications per year. See footnotes 8 and 9, page 60. 4. Do not exceed 64 oz/A/year. 5. Do not apply more than 5 lb/A/year. 6. See footnotes 2 and 6, page 60. 7. Do not apply more than 32 lb/A/year. See footnote 5, page 60.
	2. mancozeb 75DF	3 lb	0.75 lb	1	77	1	
	3. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	
	4. Procure 480SC	8-16 oz	2-4 oz	12 hr	14	1	
	5. Rally 40W	5 oz	1.25 oz	1	14	1	
	6. Syllit FL	1.5-4.5 pt	6-18 oz	2	7	1	
	7. ziram 76DF	6-8 lb	1.5-2 lb	2	14	1	
Tentiform leafminer [#]	1. Agri-Mek 0.15EC* (Other products with same ai are available.)	10-20 oz	2.5-5 oz	12 hr	28	2	1. Apply from petal fall until 6 weeks from petal fall in combination with oil at 0.25% of spray volume. Higher rates of oil volume used in combination with Agri-Mek may mark the fruit. Do not apply within 110 ft of aquatic areas. 2&3. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 12-day interval between applications. 3. See remark 2 above. 4. Do not exceed 16 oz/A/year. 5. Do not exceed 6.4 oz/A/year. 6. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year. 7. Do not exceed 9 oz/A/year. 8. Do not exceed 2 applications or 10 oz/A/year. 9. Toxic to bees. Use appropriate caution. Do not exceed 14.4 oz/A/year. 10. Do not exceed 29 oz/A/year.
	2. Assail 70WP	1.1 oz	0.27 oz	12 hr	7	2	
	3. Assail 30SG	2.5 oz	0.64 oz	12 hr	7	2	
	4. Calypso 4F	2-4 oz	0.5-1 oz	12 hr	30	2	
	5. Clutch 50WDG	3 oz	0.75 oz	12 hr	7	2	
	6. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1	
	7. Entrust 80WP	1.5-3 oz	0.37-0.75 oz	4 hr	7	1	
	8. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	45	1	
	9. Proclaim 5SG*	3.2-4.8 oz	0.8-1.2 oz	2	14	1	
	10. Success 2L	4-10 oz	1-2.5 oz	4 hr	7	1	

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
Cover sprays							See footnote 4, page 60.
Apple maggot	1. Assail 70WP	3.4 oz	0.85 oz	12 hr	7	2	1&2. Will also control codling moth if used at appropriate timing. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 12-day interval between applications.
	2. Assail 30SG	8 oz	2 oz	12 hr	7	2	2. See remark 1 above.
	3. azinphos-methyl 50WP* (azinphos-methyl 50W, Guthion Solupak)	1.5-2 lb	6-8 oz	14	14-21	3	3. Do not exceed 8 lb/A/year. Increase PHI to 21 days if last application is over 2 lb. High rates may be damaging to predatory mites.
	4. Clutch 50WDG	3 oz	0.75 oz	12 hr	7	2	4. Do not exceed 6.4 oz/A/year.
	5. Delegate 25WG	6-7 oz	1.5-1.75 oz	4 hr	7	1	5. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	6. Imidan 70WP	3-5 lb	0.75-1.25 lb	3	7	2	6. Use caution near cherry orchards due to phytotoxicity on certain cherry varieties.

COVER SPRAYS CONTINUED ON NEXT PAGE

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Cover sprays							See footnote 4, page 60.
Codling moth	1. Assail 70WP	3.4 oz	0.85 oz	12 hr	7	2	1&2. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 12-day interval between applications.
	2. Assail 30SG	8 oz	2 oz	12 hr	7	2	2. See remark 1 above.
	3. azinphos-methyl 50WP* (azinphos-methyl 50W, Guthion Solupak)	1-2 lb	4-8 oz	14	14-21	3	3. Do not exceed 6 lb/A/year. Increase PHI to 21 days if last application is over 2 lb. High rates may be damaging to predatory mites.
	4. Calypso 4F	4-8 oz	1-2 oz	12 hr	30	2	4. Apply first spray at start of egg laying to shortly before first egg hatch. Apply subsequent sprays at 2-week intervals. Do not exceed 16 oz/A/year.
	5. Delegate 25WG	6-7 oz	1.5-1.75 oz	4 hr	7	1	5. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	6. Imidan 70WP	3-5 lb	0.75-1.25 lb	3	7	2	6. Use caution near cherries due to phytotoxicity on some varieties.
	7. Rimon 0.83EC	30-50 oz	7.25-12.5 oz	12 hr	14	1	7. Can be applied with up to 0.25% HMO. Do not exceed 4 applications or 150 oz/A/year. Do not apply within 75 ft of water bodies. Maintain vegetative buffer.
Note: Contact your packing house for voluntary increased PHI for these materials.							

Codling moth—these products are suppressive and are for use in low-pressure situations in conjunction with other codling moth control measures.	1. Avaunt 30WG	5-6 oz	2.5-3 oz	12 hr	28	2	1. Apply in spray volume of 200 gal/A or less. Do not exceed 4 applications or 24 oz/A/year.
	2. Clutch 50WDG	6 oz	1.5 oz	12 hr	7	2	2. Do not exceed 6.4 oz/A/year.
	3. Granulosis virus						3a-c. Granulosis virus will cause high larval mortality but some superficial fruit damage (stings) will occur.
	a. Carpovirusine	6.8-13.5 oz	1.7-13.5 oz	4 hr	0	1	3-a. Rate per acre based on spray volume of 100 gal. Start at egg hatch and reapply at 10-day interval, as needed, to control larvae.
	b. Cyd-X + Nufilm-17	3 oz 8-16 oz	3 oz 8-16 oz	4 hr	0	1	3-b. Rate per acre based on spray volume of 100 gal. Start at egg hatch and reapply at 7-day interval, as needed, to control larvae.
	c. Virosoft	See label.	See label.	4 hr	0	1	3-c. See label.
	4. Entrust 80WP	2-3 oz	0.5-0.75 oz	4 hr	7	1	4. Do not exceed 9 oz/A/year.
5. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	45	1	5. Do not exceed 2 applications per year or 10 oz/A/year. The addition of 1% oil has been shown to increase codling moth activity of Esteem. See label for application timing.	
6. Intrepid 2F	16 oz	4 oz	4 hr	14	1	6. Apply with spreader-sticker to increase efficacy. Do not apply more than 64 oz/A/year. See label for application timing.	
7. Success 2L	6-10 oz	1.5-2.5 oz	4 hr	14	1	7. Do not exceed 29 oz/A/year. Do not apply treatments less than 14 days apart.	

COVER SPRAYS CONTINUED ON NEXT PAGE

* Restricted-use pesticide.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Cover sprays						See footnote 4, page 60.	
Leafhoppers	1. carbaryl 4L	2-4 pt	0.5-1 pt	12 hr	1	2	1. Carbaryl may disrupt integrated mite control. Use higher rate if leafhopper population is mainly adults.
	2. Centaur 70WDG	34.5 oz	8.62 oz	12 hr	14	1	2. Do not exceed 1 application or 34.5 oz/A/year.
Leafhoppers and aphids	1. Actara 25WDG	2.0-2.75 oz	0.5-0.68 oz	12 hr	14-35	2	1. Increase PHI to 35 days if application is over 2.75 oz. Do not exceed 16.5 oz/A/year. Observe 10-day interval between applications.
	2. Assail 70WP	1.1-1.7 oz	0.27-0.42 oz	12 hr	7	2	2&3. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 12-day interval between applications.
	3. Assail 30SG	2.5-4 oz	0.64-1 oz	12 hr	7	2	3. See remark 2 above.
	4. Calypso 4F	2-4 oz	0.5-1 oz	12 hr	30	2	4. Do not exceed 16 oz/A/year.
	5. Clutch 50WDG	2-3 oz	0.5-0.75 oz	12 hr	7	2	5. Do not exceed 6.4 oz/A/year.
	6. endosulfan (Thionex 50W*)	3 lb	0.75 lb	4	21	3	6. Do not exceed 3 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies.
	7. Provado 1.6F (Other products with same ai are available.)	4-8 oz	1-2 oz	12 hr	7	2	7. Allow 10 days between applications. Do not apply to bloom or when bees are present in orchard.
Leafhoppers and tarnished plant bugs	1. Avaunt 30WG	5-6 oz	2.5-3 oz	12 hr	28	2	1. Apply in spray volume of 200 gal/A or less. Do not exceed 4 applications or 24 oz/A/year.
	2. Calypso 4F	2-4 oz	0.5-1 oz	12 hr	30	2	2. Do not exceed 16 oz/A/year.

COVER SPRAYS CONTINUED ON NEXT PAGE

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Cover sprays						See footnote 4, page 60.	
Leafrollers [#]	1. <i>Bacillus thuringiensis</i> (B.t.) (Deliver, Dipel, Javelin)	Rates vary, see label	—	4 hr	1	1	1. Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays usually are needed. Pink and petal fall sprays are most critical. Apply sprays 14-21 days apart. Complete coverage is necessary for good control.
	2. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1	2. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	3. Entrust 80WP	2-3 oz	0.5-0.75 oz	4 hr	7	1	3. Do not exceed 3 applications for leafroller control per year. Do not exceed 9 oz/A/year.
	4. Intrepid 2F	16 oz	4 oz	4 hr	14	1	4. Make 1-2 applications against summer-generation larvae depending on pest pressure. Apply with spreader-sticker to increase efficacy. Do not apply more than 64 oz/A/year.
	5. Proclaim 5SG*	3.2-4.8 oz	0.8-1.2 oz	2	14	1	5. Toxic to bees. Use appropriate caution. Do not exceed 14.4 oz/A/year.
	6. Success 2L	6-10 oz	1.5-2.5 oz	4 hr	14	1	6. Do not exceed 3 applications for leafroller control per year. Do not exceed 29 oz/A/year. Do not apply treatments less than 14 days apart.

COVER SPRAYS CONTINUED ON NEXT PAGE

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
CONTINUED—Cover sprays						See footnote 4, page 60.	
Mites [#]	1. Acramite 50WS	0.75-1 lb	0.19-0.25 lb	12 hr	7	1	1. Will not control rust mites. Apply only once per year.
	2. Apollo 50SC	4-8 oz	1-2 oz	12 hr	45	1	2. Will not control rust mites. One application per year. Do not use any combination of Apollo, Onager, and Savey in the same growing season.
	3. Envidor 2SC	16-18 oz	4-4.5 oz	12 hr	7	1	3. Do not exceed 1 application or 18 oz/A/year.
	4. Fujimite 5EC	2 pt	8 oz	12 hr	14	1	4. Toxic to fish. Use appropriate caution. Do not exceed 2 applications or 32 oz/A/year.
	5. Kanemite 15SC	21-31 oz	5.25-7.75 oz	12 hr	14	1	5. Will not control rust mites. Toxic to aquatic organisms. Use appropriate caution. Do not exceed 2 applications or 62 oz/A/year. Observe 21-day interval between applications.
	6. Nexter 75WP	4.4-10.67 oz	1.1-2.6 oz	12 hr	25	1	6. For European red mite and apple rust mite only, use up to 5.2 oz/A. Results for McDaniels and twospotted spider mites have been inconsistent. Toxic to bees and fish. Use appropriate caution. Do not exceed 1 application or 10.67 oz/A/year.
	7. Onager 1EC	12-24 oz	3-6 oz	12 hr	28	1	7. Will not control rust mites. One application per year. Do not use any combination of Apollo, Onager, and Savey in the same growing season.
	8. Savey 50DF	3-6 oz	0.75-1.5 oz	12 hr	28	1	8. Will not control rust mites. One application per year. Do not use any combination of Apollo, Onager, and Savey in the same growing season.
	9. Vendex 50WP	1.5-2 lb	6-8 oz	2	14	2	9. Resistance to Vendex is present in some pear orchards.
	10. Zeal 72WDG	2-3 oz	0.5-0.75 oz	12 hr	14	1	10. Will not control rust mites. Primarily ovicidal/larvicidal. Only one application/year.
Scale crawlers only	1. Centaur 70WDG	34.5 oz	8.62 oz	12 hr	14	1	1. Do not exceed 1 application or 34.5 oz/A/year.
	2. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	45	1	2. Do not exceed 2 applications or 10 oz/A/year. Make application when scale crawlers first emerge. Oil improves performance.

COVER SPRAYS CONTINUED ON NEXT PAGE

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)	
CONTINUED—Cover sprays						See footnote 4, page 60.		
Tentiform leafminer [#]	1. Actara 25WDG	4.5-5.5 oz	1.13-1.37 oz	12 hr	14-35	2	1. Increase PHI to 35 days if application is over 2.75 oz. Do not exceed 16.5 oz/A/year. Observe 10-day interval between applications. 2&3. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 12-day interval between applications. 3. See remark 2 above. 4. Target sap-feeding stage. Do not exceed 16 oz/A/year. 5. Do not exceed 6.4 oz/A/year. 6. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year. 7. Do not exceed 9 oz/A/year. 8. Do not exceed 2 applications or 10 oz/A/year. Apply at peak moth flight. 9. Toxic to bees. Use appropriate caution. Do not exceed 14.4 oz/A/year. 10. Allow 10 days between applications. 11. Do not exceed 29 oz/A/year. Allow 14 days between applications. 12. Do not apply Vydate prior to 30 days after full bloom.	
	2. Assail 70WP	1.1-1.7 oz	0.27-0.42 oz	12 hr	7	2		
	3. Assail 30SG	2.5-4 oz	0.64-1 oz	12 hr	7	2		
	4. Calypso 4F	2-4 oz	0.5-1 oz	12 hr	30	2		
	5. Clutch 50WDG	3 oz	0.75 oz	12 hr	7	2		
	6. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1		
	7. Entrust 80WP	1.5-3 oz	0.37-0.75 oz	4 hr	7	1		
	8. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	45	1		
	9. Proclaim 5SG*	3.2-4.8 oz	0.8-1.2 oz		2	14		1
	10. Provado 1.6F (Other products with same ai are available.)	4-8 oz	1-2 oz		12 hr	7		2
	11. Success 2L	4-10 oz	1-2.5 oz		4 hr	7		1
	12. Vydate L	2 pt	0.5 pt		2	14		3
Woolly apple aphids	1. diazinon 50WP*	4 lb	1 lb	2	21	2	1. Will also control scale crawlers. 2. Resistance has been detected. Do not exceed 3 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies.	
	2. endosulfan (Thionex 50W*)	4-5 lb	1-1.25 lb	4	21	3		

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for apples (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	IFP Rating	Remarks (for material with same number)
Preharvest							
Storage rots	1. Captan 80WDG	3.75 lb	0.94 lb	1	1	2	1. Captan is no longer registered on pears due to phytotoxicity.
	2. Pristine	14.5-18.5 oz	3.6-4.6 oz	12 hr	0	1	2. Do not exceed 4 applications per year. See footnote 9, page 60.
	3. Topsin M	1.5 lb	0.37 lb	1	1	2	3. See footnote 11, page 60.
	4. ziram 76DF	6-8 lb	1.5-2 lb	2	14	2	4. See footnote 5, page 60.

Note: Contact your packing house before choosing one of these materials.

Postharvest							
Anthracnose	1. fixed copper (50-53%)	16-20 lb	4-5 lb	1	—	1	1. See footnote 12, page 60.
	+ HMO	1 gal	1 qt	4 hr	—	1	
Crown and collar rot (rare)	1. Aliette WDG	2.5-5 lb	10-20 oz	12 hr	14	1	1. Use when there is significant foliage on the tree. Do not use with copper materials.
	2. Fosphite	1-2 qt	0.25-0.5 qt	4 hr	—	1	
	3. Ridomil Gold EC	NA	0.5 pt	2	—	—	3. Rate based on tree size. Have rain or irrigation move material into root zone. Apply Ridomil before growth begins in the spring or in the fall after harvest. Soil crown drench only.

†These materials are detrimental to predatory mites with this timing.

* Restricted-use pesticide.

**Petal fall timing gives best control for bloom-time spray application.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

FOOTNOTES (Spray tips and cautions)

1. Lime sulfur, if applied alone, may be substituted for other fungicides for scab and powdery mildew control on apples if a lime sulfur and oil dormant spray was applied, and if temperatures remain below 90°F. It should be recognized that although lime sulfur and other sulfur materials are relatively low in cost, they are not without limitations. The use of sulfur may result in phytotoxicity when temperatures exceed 90°F following application. Below 50°F, the fungicidal action of sulfur is greatly reduced.

2. **Caution**—prolonged humidity or slow drying conditions following the application of dodine may result in fruit russet. DO NOT APPLY SYLLIT DURING POOR DRYING CONDITIONS.

3. Do not apply oil sprays during the growing season within 45 days of a sulfur application.

4. Caution is advised when mixing emulsifiable concentrates with other formulations. Incompatibility and/or phytotoxicity may occur

5. Ziram may cause irritation of eyes, nose, throat, and skin.

6. When scab is not a serious problem, 6 lb ziram or 6 lb (50%) captan per acre may be used instead of Syllit. Since captan is not registered for pears, do not spray mixed blocks.

7. Do not combine the 6-lb prebloom or 3-lb all-season mancozeb or Polyram schedule. See labels for details. There are several manufacturers of mancozeb with different trade names and formulations, such as Dithane M-45, Manzate 75DF, and Penncozeb 75DF.

8. Apple scab forecasting is useful when spring rains become less frequent and drier weather prevails. Several materials can be applied within a certain time limit after the *start* of an infection period. QoI materials such as Flint or Pristine, claim long kickback activity. These claims are doubtful, and actual kickback activity may be shorter (see table below for kickback estimates). These materials are best used **prior** to infection periods.

9. Do not exceed 4 total applications per year of any QoI fungicide or any combination of these fungicides such as Flint or Pristine.

10. Growers have noticed that Rally does not control powdery mildew as well at 5 oz/A as it did in the past. Higher rates and resistance management (rotation with materials in other fungicide families) are recommended.

11. The resistance risk of Topsin is considered high. We suggest using alternative products this year if Topsin was used last year for management of storage rots.

12. Fixed copper products include trade names such as Champ, C-O-C-S, Copper-Count-N, Cuprofix Disperss, Kocide, Nordox, and Nu-Cop.

Effectiveness of fungicides for control of apple diseases*

Apple scab

Fungicide	Fungicide family	Overall	Protection	Kickback	Presymptom activity	Postsymptom activity	Powdery mildew	Bull's eye rot
				from start of infection period (hours)				
Captan	Phthalimide	Excellent	Very good	18-24	None	None	None	Good
Flint	Qol	Excellent**	Very good	48-72	Good	Fair	Good-excellent**	??
Horticultural mineral oil (HMO)	Oil	??	??	??	??	??	Good	??
Lime sulfur	Inorganic	Excellent	Good	??	None	??	Good	??
mancozeb	EBDC	Excellent	Very good	18-24	None	None	None	Slight-fair
Polyram	EBDC	Excellent	Very good	18-24	None	None	None	??
Procure	DMI	Good**	Fair	72-96	Excellent	Fair-good	Excellent**	??
Pristine	Qol + boscalid	Good-excellent	Good	??	??	??	Excellent	??
Rally	DMI	Good**	Fair	72-96	Excellent	Fair-good	Excellent**	??
Rubigan	DMI	Good**	Fair	72-96	Excellent	Fair-good	Excellent**	??
Sulfur	Inorganic	Fair	Fair	0	None	None	Good	??
Syllit	Guanidine	Excellent**	Very good	18-24	Excellent	Very good	None	??
Topsin M	benzimidazole	Fair**	Fair	18-24	Excellent	Very good	Fair-good**	Excellent
Vangard	Anilino-pyrimidine	Fair**	Fair	48	??	??	None	??
Ziram	EBDC-like	Fair	Fair-good	??	None	None	None	Excellent

*These ratings are relative rankings based on labeled application rates, good spray coverage, and proper spray timing. Actual levels of disease control will be influenced by these factors in addition to cultivar susceptibility, disease pressure, and weather conditions.

**Resistant pathogens will lower the effectiveness of these fungicides.

2008 Mid-Columbia pest control program for cherries

Application rates in the tables are for dilute sprays, generally estimated as 400 gallons per acre. Gallonage requirements vary depending on tree size, shape, and spray equipment. Large, heavily barked trees infested with scale insects may need to be sprayed with more than 400 gallons of spray solution per acre, but never exceed the labeled rate per acre. Base CONCENTRATE SPRAYS on the amount of formulation given per acre unless indicated otherwise on a product's label.

Use only one material except where a combination is indicated. Follow label precautions when tank-mixing oils, fungicides, and insecticides. **MATERIALS ARE LISTED ALPHABETICALLY.**

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
Dormant or delayed dormant (Stages 1 and 2)						
Scale, mites, aphids	1. horticultural mineral oil (HMO)	6-8 gal	1.5-2 gal	4 hr	—	
	2. HMO	6-8 gal	1.5-2 gal	4 hr	—	
	+ a. diazinon 50WP*	4 lb	1 lb	2	21	a. Do not exceed 4 lb of product or 6 gal of oil per acre.
	b. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	14	b. Do not exceed 3 applications or 15 oz/A/year.
	c. Lorsban 4E* d. Supracide 2E*	4 pt 3-12 pt	1 pt 1-2 pt	4 2-14	prebloom prebloom	c. Prebloom use only. d. Increase REI to 14 days if application is over 8 pt per acre. Prebloom use only. Supracide without oil will not control European red mite eggs.
Bacterial canker	1. fixed copper (50-53%)	8-16 lb	2-4 lb	1	prebloom	1. Spray thoroughly for good coverage. See footnote 2, page 74.

See "Twelve steps to manage bacterial canker of sweet cherry," page 23.

Combined delayed dormant–popcorn (Stages 3 and 4)						
Scale, leafrollers [#] , aphids	1. HMO	6 gal	1.5 gal	4 hr	—	
	+ a. diazinon 50WP*	4 lb	1 lb	2	21	a. Do not exceed 4 lb of product or 6 gal of oil per acre.
	b. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	14	b. Do not exceed 3 applications or 15 oz/A/year.
	c. Lorsban 4E* d. Supracide 2E*	4 pt 3-12 pt	1 pt 1-2 pt	4 2-14	prebloom prebloom	c. Prebloom use only. d. Increase REI to 14 days if application is over 8 pt per acre. Prebloom use only.

Popcorn (Stages 4 and 5)						
Leafroller [#] , syneta beetle, bud moth, black cherry aphid, thrips, mineola moth	1. diazinon 50WP*	4 lb	1 lb	2	21	1. Do not exceed 4 lb per acre. 2&3. Toxic to bees. Use appropriate caution. Do not exceed 2 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies. Closed cabs required for airblast application. 3. See remark 2 above.
	2. endosulfan (Thionex 50W*)	4 lb	1 lb	4	21	
	3. endosulfan 3EC (Thionex 3EC*, Endosulfan 3EC*)	2.67 qt	0.67 qt	2	21	

POPCORN CONTINUED ON NEXT PAGE

* Restricted-use pesticide.

[#] This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for cherries (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
CONTINUED—Popcorn—(Stages 4 and 5)						
Leafrollers [#]	1. <i>Bacillus thuringiensis</i> (B.t.) (Deliver, Dipel, Javelin)	Rates vary, see label	—	4 hr	0	1. Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays are needed. Apply sprays 14-21 days apart.
	2. Intrepid 2F	8-16 oz	2-4 oz	4 hr	7	2. Apply with spreader-sticker to increase efficacy.
Popcorn—Full bloom (Stages 4-7)						
	1. Bravo Weather Stik	3-4.1 pt	16-22 oz	12 hr	—	1. Do not apply later than shuck split.
	2. Cabrio EG	9.5 oz	2.4 oz	12 hr	0	2. Do not exceed 5 applications per year. See footnote 4, page 74.
	3. Elevate 50WDG	1-1.5 lb	4-6 oz	12 hr	0	
	4. Elite 45DF	4-8 oz	1-2 oz	12 hr	0	
	5. Indar 75WSP	2 oz	0.5 oz	12 hr	0	
	6. Orbit/Tilt	4 oz	1 oz	1 day/12 hr	0	
	7. Pristine	10.5-14.5 oz	2.63-3.63 oz	12 hr	1	7. Do not exceed 2 sequential applications or 5 applications per year. See footnote 4, page 74.
	8. Procure 480SC	12-16 oz	3-4 oz	12 hr	1	8. Do not exceed 96 oz/A/year.
	9. Rally 40W	2.5-6 oz	1.25-2 oz	1	7	9. Do not apply more than 3.25 lb/A/year.
	10. ziram 76DF	4-6 lb	1.3-1.6 lb	2	30	10. See footnote 3, page 74. Rate based on 300 gal/A.
Leafrollers [#] and thrips	1. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	2. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	7	2. Toxic to bees. Minimize bee hazard by spraying before bees are placed in the orchard. Do not exceed 9 oz/A/year.
	3. Success 2L	4-8 oz	1-2 oz	4 hr	7	3. Toxic to bees. Minimize bee hazard by spraying before bees are placed in the orchard. Do not exceed 29 oz/A/year.

* Restricted-use pesticide.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for cherries (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
Petal fall						
Aphids	1. Actara 25WDG	3-4 oz	0.75-1 oz	12 hr	14	1. Do not exceed 11 oz/A/year. Observe 7-day interval between applications. Toxic to bees. Use appropriate caution. 2&3. Toxic to bees. Use appropriate caution. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 10-day interval between applications. 3. See remark 2 above. 4. Remove bees prior to application. 5 & 6. Toxic to bees. Use appropriate caution. Do not exceed 2 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies. Closed cabs required for airblast application. 6. See remark 5 above. 7. Allow 10 days between applications. Do not apply to bloom or when bees are present in orchard.
	2. Assail 70WP	1.1-2.3 oz	0.27-0.57 oz	12 hr	7	
	3. Assail 30SG	2.5-5.3 oz	0.64-1.34 oz	12 hr	7	
	4. diazinon 50WP*	4 lb	1 lb	2	21	
	5. endosulfan (Thionex 50W*)	4 lb	1 lb	4	21	
	6. endosulfan 3EC (Thionex 3EC*, Endosulfan 3EC*)	2.67 qt	0.67 qt	2	21	
	7. Provado 1.6F (Other products with same ai are available.)	4-8 oz	1-2 oz	12 hr	7	
Leafrollers [#]	1. <i>Bacillus thuringiensis</i> (B.t.) (Deliver, Dipel, Javelin)	Rates vary, see label	—	4 hr	0	1. Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays are needed. Apply sprays 14-21 days apart.
	2. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	2. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	3. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	7	3. Remove bees prior to application. Do not exceed 9 oz/A/year.
	4. Intrepid 2F	8-16 oz	2-4 oz	4 hr	7	4. Apply with spreader-sticker to increase efficacy.
	5. Success 2L	4-8 oz	1-2 oz	4 hr	7	5. Remove bees prior to application. Do not exceed 29 oz/A/year.

* Restricted-use pesticide.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for cherries (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
Shuck fall						
Powdery mildew See footnote 5, page 74.	1. Cabrio EG	9.5 oz	2.4 oz	12 hr	0	1. Do not exceed 5 applications per year. See footnote 4, page 74. 2. Temperature 90°F or above following sulfur application may result in injury. A second application 2-3 weeks after shuck fall may be necessary to aid in fruit protection. 4. Do not exceed 4 applications per year. See footnote 4, page 74. 5. Do not use after pit hardening. Necrotic foliage may result if applied within 2 weeks of any sulfur application. 7. Do not exceed 2 sequential applications or 5 applications per year. See footnote 4, page 74. 8. Do not exceed 96 oz/A/year. 9. Do not exceed 7 oz/A/application, 5 applications/year, or 35 oz/A/year. Toxic to fish and aquatic invertebrates. Use appropriate caution. 10. Do not apply more than 3.25 lb/A/year. 11. To prevent resistance development, tank mix with another fungicide, use only once per season, and rotate with other chemistries.
	2. DF sulfur	10-15 lb	2.5-3.75 lb	1	1	
	3. Elite 45DF	8 oz	2 oz	12 hr	0	
	4. Gem 500SC	2-3.8 oz	0.5-0.95 oz	12 hr	1	
	5. HMO	See label	See label	4 hr	—	
	6. Orbit/Tilt	4 oz	1 oz	1 day/12 hr	0	
	7. Pristine	10.5-14.5 oz	2.63-3.63 oz	12 hr	0	
	8. Procure 480SC	10-16 oz	2.5-4 oz	12 hr	1	
	9. Quintec	7 oz	1.75 oz	12 hr	7	
	10. Rally 40W	2.5-6 oz	1.25-2 oz	1	7	
	11. Topsin M	1-1.5 lb	4-6 oz	12 hr	1	
Leafhoppers	1. Actara 25WDG	2-2.75 oz	0.5-0.68 oz	12 hr	14	1. Do not exceed 11 oz/A/year. Observe 7-day interval between applications. Toxic to bees. Use appropriate caution. 2&3. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 10-day interval between applications. 3. See remark 2 above. 5&6. Do not exceed 2 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies. Closed cabs required for airblast application. 6. See remark 5 above. 7. Allow 10 days between applications.
	2. Assail 70WP	1.1-2.3 oz	0.27-0.57 oz	12 hr	7	
	3. Assail 30SG	2.5-5.3 oz	0.64-1.34 oz	12 hr	7	
	4. carbaryl 4L	1.5-2 qt	0.75-1 pt	12 hr	3	
	5. endosulfan (Thionex 50W*)	3 lb	0.75 lb	4	21	
	6. endosulfan 3EC (Thionex 3EC*, Endosulfan 3EC*)	2 qt	0.5 qt	2	21	
	7. Provado 1.6F (Other products with same ai are available.)	4-8 oz	1-2 oz	12 hr	7	

SHUCK FALL CONTINUED ON NEXT PAGE

* Restricted-use pesticide.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for cherries (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
CONTINUED— Shuck fall						
Leafrollers [#]	1. <i>Bacillus thuringiensis</i> (B.t.) (Deliver, Dipel, Javelin)	Rates vary, see label	—	4 hr	0	1. Apply when temperatures will exceed 60°F. For effective control, 2 to 3 sprays are needed. Apply sprays 14-21 days apart.
	2. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	2. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	3. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	7	3. Do not exceed 9 oz/A/year.
	4. Intrepid 2F	8-16 oz	2-4 oz	4 hr	7	4. Apply with spreader-sticker to increase efficacy.
	5. Success 2L	4-8 oz	1-2 oz	4 hr	7	5. Research results indicate petal fall spray gives best control. Do not exceed 29 oz/A/year.
Tentiform leafminer [#]	1. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	2. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	7	2. Do not exceed 9 oz/A/year.
	3. Intrepid 2F	8-16 oz	2-4 oz	4 hr	7	3. Apply with a spreader-sticker to increase efficacy.
	4. Success 2L	4-8 oz	1-2 oz	4 hr	7	4. Do not exceed 29 oz/A/year.
Powdery mildew See footnote 5, page 74.	1. Cabrio EG	9.5 oz	2.4 oz	12 hr	0	1. Do not exceed 5 applications per year. See footnote 4, page 74.
	2. DF sulfur	10-15 lb	2.5-3.75 lb	1	1	2. Temperature 90°F or above following sulfur application may result in injury. A second application 2-3 weeks after shuck fall may be necessary to aid in fruit protection.
	3. Elite 45DF	8 oz	2 oz	12 hr	0	
	4. Gem 500SC	2-3.8 oz	0.5-0.95 oz	12 hr	1	4. Do not exceed 4 applications per year. See footnote 4, page 74.
	5. HMO	See label	See label	4 hr	—	5. Do not use after pit hardening. Necrotic foliage may result if applied within 2 weeks of any sulfur application.
	6. Orbit/Tilt	4 oz	1 oz	1 day/12 hr	0	
	7. Pristine	10.5-14.5 oz	2.63-3.63 oz	12 hr	0	7. Do not exceed 2 sequential applications or 5 applications per year. See footnote 4, page 74.
	8. Procure 480SC	10-16 oz	2.5-4 oz	12 hr	1	8. Do not exceed 96 oz/A/year.
	9. Quintec	7 oz	1.75 oz	12 hr	7	9. Do not exceed 7 oz/A/application, 5 applications/year, or 35 oz/A/year. Toxic to fish and aquatic invertebrates. Use appropriate caution.
	10. Rally 40W	2.5-6 oz	1.25-2 oz	1	7	10. Do not apply more than 3.25 lb/A/year.
	11. Topsin M	1-1.5 lb	4-6 oz	12 hr	1	11. To prevent resistance development, tank mix with another fungicide, use only once per season, and rotate with other chemistries.

NOTE: Contact your packing shed before choosing any of the products listed above to ensure compliance with export restrictions.

* Restricted-use pesticide.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for cherries (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
Mid-May						
Shothole borer	1. endosulfan (Thionex 50W*)	4 lb	1 lb	4	21	1&2. Prompt removal and burning of prunings are important in control of shothole borer. Endosulfan is used with good results in the Willamette Valley. Do not exceed 2 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies. Closed cabs required for airblast application. 2. See remark 1 above.
	2. endosulfan 3EC (Thionex 3EC*, Endosulfan 3EC*)	2.67 qt	0.67 qt	2	21	
Tentiform leafminer#	1. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year. 2. Do not exceed 9 oz/A/year. 3. Apply with a spreader-sticker to increase efficacy. 4. Do not exceed 29 oz/A/year.
	2. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	7	
	3. Intrepid 2F	8-16 oz	2-4 oz	4 hr	7	
	4. Success 2L	4-8 oz	1-2 oz	4 hr	7	

MID-MAY CONTINUED ON NEXT PAGE

* Restricted-use pesticide.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for cherries (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
CONTINUED— Mid-May						
Cherry fruit fly See footnote 1 page 74.	1. Actara 25WDG	4.5-5.5 oz	1.13-1.37 oz	12 hr	14	1. Do not exceed 11 oz/A/year. Observe 7-day interval between applications. Repeated applications may cause spider mite buildup.
	2. Assail 70WP	2.3-3.4 oz	0.57-0.85 oz	12 hr	7	2&3. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 10-day interval between applications.
	3. Assail 30SG	5.3-8 oz	1.34-2 oz	12 hr	7	3. See remark 2 above.
	4. azinphos-methyl 50WP* (azinphos-methyl 50W, Guthion Solupak)	1.5 lb	6 oz	15	15	4. May cause phytotoxicity on some cultivars. Do not exceed 2 applications or 3 lb/A/yr.
	5. carbaryl 4L	1.5-2 qt	0.75-1 pt	12 hr	3	5. Repeated applications may cause spider mite buildup.
	6. Delegate 25WG	4.5 oz	1.13 oz	4 hr	7	6. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	7. diazinon 50WP*	4 lb	1 lb	2	21	
	8. dimethoate 400	2 pt	0.5 pt	2	21	8. Make a single application within 7 days of adult fly emergence in area. High label rates can cause phytotoxicity ranging from marginal leaf burn to defoliation, especially in hot weather. Note: Do not use on cherries to be marketed in Japan.
	9. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	7	9. Do not exceed 9 oz/A/yr.
	10. GF-120	20 oz	—	4 hr	0	10. Apply every 7 days with first application immediately after first emergence. For ATV applications, apply in 0.8 to 1 gallon water/A using a D2 nozzle with core removed. Applications should be made at 6 to 7 mph with the listed rate and nozzle size. See label for proper dilutions.
	11. malathion 8EC. (Other formulations are available. WP may leave visible residue at harvest.)	3 pt	0.75 pt	12 hr	3	
	12. malathion ULV	12-16 oz	—	12 hr	1	
	13. Provado 1.6F (Other products with same ai are available.)	4-8 oz	1-2 oz	12 hr	7	13. Repeated applications may cause spider mite buildup. Allow 10 days between applications.
	14. Success 2L	4-8 oz	1-2 oz	4 hr	7	14. Do not exceed 29 oz/A/year. Multiple uses of Success for cherry fruit fly control will increase chances for resistance development in other pests (i.e., leafrollers and leafminers).

MID-MAY CONTINUED ON NEXT PAGE

* Restricted-use pesticide.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for cherries (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
CONTINUED— Mid-May						
Scale crawlers	1. Assail 70WP	2.3-3.4 oz	0.57-0.85 oz	12 hr	7	1,2,3,4,5. Apply at beginning of crawler emergence. 1&2. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. Observe 10-day interval between applications.
	2. Assail 30SG	5.3-8 oz	1.34-2 oz	12 hr	7	2. See remark 1 above.
	3. diazinon 50WP*	4 lb	1 lb	2	21	
	4. Esteem 35WP	4-5 oz	1-1.25 oz	12 hr	14	4. Do not exceed 3 applications or 15 oz/A/year.
	5. Provado 1.6F (Other products with same ai are available.)	4-8 oz	1-2 oz	12 hr	7	5. Repeated applications may cause spider mite buildup. Allow 10 days between applications.
Leafrollers [#]	1. azinphos-methyl 50WP* (azinphos-methyl 50W, Guthion Solupak)	1.5 lb	6 oz	15	15	1. May cause phytotoxicity on some cultivars. Do not exceed 2 applications or 3 lb/A/yr.
	2. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	2. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	3. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	7	3. Do not exceed 9 oz/A/year.
	4. Intrepid 2F	8-16 oz	2-4 oz	4 hr	7	4. Apply with a spreader-sticker to increase efficacy.
	5. Success 2L	4-8 oz	1-2 oz	4 hr	7	5. Do not exceed 29 oz/A/year.
Preharvest						
Birds	1. Methyl anthranilate (Birdshield, Rejex-it Migrate)	Rates vary, see label	—	—	—	1. Best if used as part of integrated program including scare devices such as cannons and distress alarms.

PREHARVEST CONTINUED ON NEXT PAGE

*Restricted-use pesticide.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for cherries (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
CONTINUED—Preharvest						
Powdery mildew See footnote 5, page 74.	1. Cabrio EG	9.5 oz	2.4 oz	12 hr	0	1. Do not exceed 5 applications per year. See footnote 4, page 74.
	2. DF sulfur	10-15 lb	2.5-3.75 lb	1	1	2. Temperature of 90°F or above following sulfur application may result in injury. A second application 2-3 weeks after shuck fall may be needed to aid in fruit protection.
	3. Elite 45DF	8 oz	2 oz	12 hr	0	
	4. Gem 500SC	2-3.8 oz	0.5-0.95 oz	12 hr	1	4. Do not exceed 4 applications per year. See footnote 4, page 74.
	5. Kaligreen	2.5-3 lb	0.63-0.75 lb	4 hr	1	5. Do not mix with acidic products.
	6. Orbit/Tilt	4 oz	1 oz	1 day/12 hr	0	
	7. Pristine	10.5-14.5 oz	2.63-3.63 oz	12 hr	0	7. Do not exceed 2 sequential applications or 5 applications per year. See footnote 4, page 74.
	8. Procure 480SC	10-16 oz	2.5-4 oz	12 hr	1	8. Do not exceed 96 oz/A/year.
	9. Quintec	7 oz	1.75 oz	12 hr	7	9. Do not exceed 7 oz/A/application, 5 applications/year, or 35 oz/A/year. Toxic to fish and aquatic invertebrates. Use appropriate caution.
	10. Rally 40W	2.5-6 oz	1.25-2 oz	1	7	10. Do not apply more than 3.25 lb/A/year.
	11. Topsin M	1-1.5 lb	4-6 oz	12 hr	1	11. To prevent resistance development, tank mix with another fungicide, use only once per season, and rotate chemistries.

NOTE: Contact your packing shed before choosing any of the products listed above to ensure compliance with export restrictions.

Brown rot	1. Cabrio EG	9.5 oz	2.4 oz	12 hr	0	1. Do not exceed 5 applications per year. See footnote 4, page 74.
	2. DF sulfur	10-15 lb	2.5-3.75 lb	1	1	2. Temperature 90°F or above following sulfur application may result in injury. A second application 2-3 weeks after shuck fall may be necessary to aid in fruit protection.
	3. Elevate 50WDG	1-1.5 lb	4-6 oz	12 hr	0	
	4. Elite 45DF	8 oz	2 oz	12 hr	0	
	5. Indar 75WSP	2 oz	0.5 oz	12 hr	0	
	6. Orbit/Tilt	4 oz	1 oz	1 day/12 hr	0	
	7. Pristine	10.5-14.5 oz	2.63-3.63 oz	12 hr	0	7. Do not exceed 2 sequential applications or 5 applications per year. See footnote 4, page 74.
	8. Procure 480SC	10-16 oz	2.5-4 oz	12 hr	1	8. Do not exceed 96 oz/A/year.
	9. Topsin M	1-1.5 lb	4-6 oz	12 hr	1	9. To prevent resistance development, tank mix with another fungicide, use only once per season, and rotate with other chemistries.

NOTE: Contact your packing shed before choosing any of the products listed above to ensure compliance with export restrictions.

PREHARVEST CONTINUED ON NEXT PAGE

*Restricted-use pesticide.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for cherries (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
CONTINUED—Preharvest						
Leafrollers [#]	1. <i>Bacillus thuringiensis</i> (B.t.) (Deliver, Dipel, Javelin)	Rates vary, see label	—	4 hr	0	1. Apply 5-7 days before harvest when very small larvae are present.
	2. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	2. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	3. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	7	3. Do not exceed 9 oz/A/year.
	4. Intrepid 2F	8-16 oz	2-4 oz	4 hr	7	4. Apply with a spreader-sticker to increase efficacy.
	5. Success 2L	4-8 oz	1-2 oz	4 hr	7	5. Do not exceed 29 oz/A/year.
Spider mites [#]	1. Acramite	0.75-1.0 lb	0.19-0.25 lb	12 hr	3	1. Do not exceed 1 application per year.
	2. Envidor 2SC	16-18 oz	4-4.5 oz	12 hr	7	2. Do not exceed 1 application or 18 oz/A/year.
	3. Vendex 50WP	1.5-3 lb	6-12 oz	2	14	3. Do not exceed 4.5 lb/A/year.
Tentiform leafminer [#] and western flower thrips	1. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	2. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	7	2. Do not exceed 9 oz/A/year.
	3. Success 2L	4-8 oz	1-2 oz	4 hr	7	3. Do not exceed 29 oz/A/year.

*Restricted-use pesticide.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for cherries (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
Postharvest						
Cherry fruit fly See footnote 1, page 74.	1. Actara 25WDG	4.5-5.5 oz	1.13-1.37 oz	12 hr	14	1. Do not exceed 11 oz/A/year. Observe 7-day interval between applications. Repeated applications may cause spider mite buildup. 2&3. Addition of HMO at up to 0.5% of spray volume has been shown to improve activity and suppress spider mites. Do not exceed 4 applications or 0.6 lb ai/A/year. 10-day interval between applications. 3. See remark 2 above. 4. May cause phytotoxicity on some cultivars. Do not exceed 2 applications or 3 lb/A/yr. 6. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year. 8. High label rates can cause phytotoxicity ranging from marginal leaf burn to defoliation, especially in hot weather. Do not use on cherries to be marketed in Japan. 9. Do not exceed 9 oz/A/yr. 10. Apply every 7 days after harvest as long as unharvested fruit remains on trees. For ATV applications, apply in 0.8 to 1 gallon water/A using a D2 nozzle with core removed. Applications should be made at 6 to 7 mph with the listed rate and nozzle size. See label for proper dilutions. 12. Repeated applications may cause spider mite buildup. Allow 10 days between applications. 13. Do not exceed 29 oz/A/year. Multiple uses of Success for cherry fruit fly control will increase chances for resistance development in other pests (i.e., leafrollers and leafminers).
	2. Assail 70WP	2.3-3.4 oz	0.57-0.85 oz	12 hr	7	
	3. Assail 30SG	5.3-8 oz	1.34-2 oz	12 hr	7	
	4. azinphos-methyl 50WP* (azinphos-methyl 50W, Guthion Solupak)	1.5 lb	6 oz	15	15	
	5. carbaryl 4L	1.5-2 qt	0.75-1 pt	12 hr	3	
	6. Delegate 25WG	4.5 oz	1.13 oz	4 hr	7	
	7. diazinon 50WP*	4 lb	1 lb	2	21	
	8. dimethoate 400	2 pt	0.5 pt	2	21	
	9. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	7	
	10. GF-120	20 oz	—	4 hr	0	
	11. malathion 8EC. (Other formulations are available.)	3 pt	0.75 pt	12 hr	3	
	12. Provado 1.6F (Other products with same ai are available.)	4-8 oz	1-2 oz	12 hr	7	
	13. Success 2L	4-8 oz	1-2 oz	4 hr	7	
Pear slug	1. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	7	1, 2. Repeated applications may encourage resistance in leafrollers and leafminers. 1. Do not exceed 9 oz/A/year. 2. Do not exceed 29 oz/A/year.
	2. Success 2L	4-8 oz	1-2 oz	4 hr	7	

Note: Postharvest cherry fruit fly spray will generally control pear slug.

POSTHARVEST CONTINUED ON NEXT PAGE

*Restricted-use pesticide.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for cherries (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
CONTINUED—Postharvest						
Shothole borer	1. endosulfan (Thionex 50W*)	4 lb	1 lb	4	21	1&2. Prompt removal and burning of prunings are important in control of shothole borer. Endosulfan is used with good results in the Willamette Valley. Do not exceed 2 applications or 2.5 lb ai/A/year. 30-ft vegetated buffer and 100-ft unsprayed buffer required between treated area and water bodies. Closed cabs required for airblast application. 2. See remark 1 above.
	2. endosulfan 3EC (Thionex 3EC*, Endosulfan 3EC*)	2.67 qt	0.67 qt	2	21	
Spider mites [#] only	1. Acramite	0.75-1.0 lb	0.19-0.25 lb	12 hr	3	1. Do not exceed 1 application per year. 2. One application per year. Do not use any combination of Apollo, Onager, and Savey in the same growing season. 3. For use after harvest or in nonbearing orchards only. Do not exceed 2 applications, minimum interval of 21 days. 4. One application per year. Do not use any combination of Apollo, Onager, and Savey in the same growing season. 5. One application per year. Do not use any combination of Apollo, Onager, and Savey in the same growing season.
	2. Apollo 50SC	4-8 oz	1-2 oz	12 hr	—	
	3. Omite 30W	6 lb	1.5 lb	7	—	
	4. Onager 1EC	24 oz	6 oz	12 hr	—	
	5. Savey 50DF	3-6 oz	0.75-1.5 oz	12 hr	—	
Spider mites [#] and rust mites	1. Envidor 2SC	16-18 oz	4-4.5 oz	12 hr	—	1. Do not exceed 1 application or 18 oz/A/year. 2. Necrotic foliage may result if applied within 2 weeks of any sulfur application.
	2. HMO	1-2 gal	1-2 qt	4 hr	—	
	3. Vendex 50WP	1.5-2 lb	6-8 oz	2	—	
Tentiform leafminer [#]	1. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	1,2,4. Repeated applications may encourage resistance development in leafrollers and leafminers. 1. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year. 2. Do not exceed 9 oz/A/year. 3. Apply with a spreader-sticker to increase efficacy. 4. Do not exceed 29 oz/A/year.
	2. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	—	
	3. Intrepid 2F	8-16 oz	2-4 oz	4 hr	—	
	4. Success 2L	4-8 oz	1-2 oz	4 hr	—	

POSTHARVEST CONTINUED ON NEXT PAGE

*Restricted-use pesticide.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

2008 Mid-Columbia pest control program for cherries (continued)

Pest	Material	Amt./acre	Amt./100 gal (Dilute spray)	Restricted-entry interval (days)	Minimum days from last application to harvest	Remarks (for material with same number)
CONTINUED—Postharvest						
Redhumped caterpillar	1. <i>Bacillus thuringiensis (B.t.)</i> (Deliver, Dipel, Javelin)	Rates vary, see label	—	4 hr	—	
	2. Delegate 25WG	4.5-7 oz	1.13-1.75 oz	4 hr	7	2. Do not exceed 4 applications per year. Do not exceed 28 oz/A/year.
	3. Entrust 80WP	1.25-2.5 oz	0.3-0.6 oz	4 hr	—	3. Do not exceed 9 oz/A/year.
	4. Intrepid 2F	8-16 oz	2-4 oz	4 hr	—	4. Apply with spreader-sticker to increase efficacy.
	5. Success 2L	4-8 oz	1-2 oz	4 hr	—	5. Do not exceed 29 oz/A/year.
Powdery mildew See footnote 5, below.	1. HMO	1-2%	1-2%	4 hr	—	1. Use immediately after harvest, not in the fall. Necrotic foliage may result if applied within 2 weeks of any sulfur application.
	2. lime sulfur (29%)	10 gal	—	2	—	2. Use just before leaf fall. Thorough coverage of all tree parts essential.
Sept-Oct before fall rain						
Bacterial canker	1. fixed copper (50-53%)	8-12 lb	2-3 lb	1	—	1. Spray thoroughly for good coverage. See footnote 2, below.

See "Twelve steps to manage bacterial canker of sweet cherry," page 23.

*Restricted-use pesticide.

This pest has a history of developing resistance to chemical controls. Careful resistance management practices (alternating control chemistry if possible, careful use of products, and use of biological control where feasible) are strongly recommended.

FOOTNOTES (Spray tips and cautions)

1. *Fruit Fly*:

- A. Apply first spray when flies emerge; notice usually is mailed to growers.
- B. The estimated days of protection for the recommended materials are as follows:

Actara	10 days	Assail.....	10 days	azinphos-methyl*	14 days
carbaryl 4L	7 days	Delegate	10 days	diazinon	10 days
dimethoate	21 days	GF-120	7 days	Success, Entrust	7 days
malathion	7 days	Couraze, Provado.....	10 days		

* May cause phytotoxicity on some cultivars.

- C. Precipitation can affect residual activity. Check with Extension agent or field representative concerning advisability of reapplication after a rain.
- 2. Some reports indicate that these sprays give control of bacterial canker; other reports indicate little effect. Further research is necessary before a recommendation can be made. The suggested spray program is the only one that shows promise of bacterial canker control. Thoroughly spray the trunks and lower scaffolds as well as upper branches. Fixed copper products include trade names such as Champ, C-O-C-S, Copper-Count-N, Cuprofix Disperss, Kocide, Nordox, and Nu-Cop. **See "Twelve steps to manage bacterial canker of sweet cherry," page 23.**
- 3. Ziram may cause irritation of eyes, nose, throat, and skin.
- 4. Qol fungicides (Abound, Cabrio, Gem, Pristine, Quilt) are best used before symptoms of disease, such as powdery mildew, develop. Sprayers used for Abound **should not be used on apples** such as Gala, Cox's Orange Pippin, and McIntosh. Alternate Qol fungicide applications with other fungicides. Most Qol fungicides are limited to 2 sequential applications and 4 total applications of any combination of these fungicides during the year.
- 5. Use fungicides with different modes of action for management of powdery mildew. See table on next page.

Effectiveness of fungicides and bactericides for control of cherry diseases*

Fungicide	Fungicide family	Properties	Brown rot		Powdery mildew	Shothole	Pseudomonas bacterial canker
			Blossom blight	Fruit rot			
Abound	QoI	B, F, Ls, P	Good	Good	Excellent**	Fair to good	Not effective
Botran	Chlorophenyl	F, P	Fair	Fair	Not effective	??	Not effective
Bravo	Chloronitrile	B, F, P	Good to fair	Not registered	Not effective	Good	Not effective
Cabrio	QoI	B, F, Ls, P	Good	Good	Excellent**	??	Not effective
Captan	Phthalimide	B, F, P	Good	Good	Not effective	Good to excellent	Not effective
Copper-based products	Inorganic	B, Bact, F, P	Slight	Not registered	Slight	Good	Fair to excellent**
Echo 720	Chloronitrile	B, F, P	Good to fair	Not registered	Not effective	Good	Not effective
Elevate	Hydroxyanilide	F, N, P	Good to excellent	Good to excellent	Not effective	??	Not effective
Elite	DMI	B-N, C, F, Ls, P	Good to excellent	Good to excellent	Good**	??	Not effective
Gem	QoI	B, F, Ls, P	??	Moderate to good	Excellent**	??	Not effective
Indar	DMI	B-N, C, F, Ls, P	Excellent**	Excellent**	Slight**	??	Not effective
Horticultural mineral oil (HMO)	Oils	E, F, I, P	??	??	Good to excellent	??	??
Kaligreen	Bicarbonate	E, B-N	??	??	Poor to moderate	??	??
Orbit	DMI	B-N, C, F, Ls, P	Excellent	Excellent	Good**	Slight	Not effective
Pristine	QoI plus boscalid	B, F, Ls, P	Good to excellent	Good to excellent	Excellent	??	Not effective
Procure	DMI	B-N, C, F, Ls, P	Good	??	Good**	??	Not effective
Quilt	QoI plus DMI	B-N, C, F, Ls, P	Good to excellent	Good to excellent	Excellent	??	Not effective
Quintec	Group 13	N, F, P	Not effective	Not effective	Excellent effective	Not effective	Not effective
Rally	DMI	B-N, C, F, Ls, P	Good-fair	Good-fair	Good**	Slight	Not effective
Rovral	Dicarboximide	B-N, F, Ls, P	Excellent**	Not registered	Not effective	Fair to good	Not effective
Rubigan	DMI	B-N, C, F, Ls, P	Not registered	Good	Good to fair**	??	Not effective
Sulfur	Inorganic	F, I, P, V	Fair	Fair	Good	Not effective	Not effective
Syllit	Guanidine	B, F, P	??	Slight	Not effective	??	None to slight
Topsin M	Benzimidazole	B, C, F, Ls	Good**	Good**	Good**	Not effective	Not effective
Ziram	EBDC-like	B, F, P	Slight	Slight	Not effective	Good to excellent	Not effective

*These ratings are relative rankings based on labeled application rates, good spray coverage, and proper spray timing. Actual levels of disease control will be influenced by these factors in addition to cultivar susceptibility, disease pressure, and weather conditions.

**Resistant pathogens will lower the effectiveness of these fungicides.

Properties: B=broad spectrum activity; Bact=bactericidal; B-N=broad to narrow spectrum of activity; C=curative; DMI=demethylation-inhibiting; E=eradicant; F=fungicidal; Fs=fungistatic; I= insecticidal; Ls=locally systemic; N=narrow spectrum of activity; P=protectant; V=vapor active; ??=unknown.

Nutrient sprays

Soil and leaf analysis

Soil pH (acidity or alkalinity) and the levels of certain mineral elements can be determined by submitting soil samples for analysis. Mineral analysis of leaf samples taken in August may be helpful in assessing tree nutrient status. An annual soil and leaf analysis is the best way to monitor orchard mineral nutrition status. Leaf and soil analysis can be done by several private labs in the region. EM 8677, Laboratories Serving Oregon: Soil, Water, Plant Tissue, and Feed Analysis, is available from the OSU Extension office in your county and on the Web at: <http://extension.oregonstate.edu/catalog/html/em/em8677/>.

Tree nutrient needs and foliar fertilization

Trees need large amounts (pounds/acre) of certain nutrients every year. These nutrients are referred to as “macronutrients,” and include nitrogen, phosphorus, potassium, calcium, and magnesium. Soil-applied fertilizers usually are the best (biologically and economically) way to get macronutrients into the tree. However, foliar fertilization sometimes can be beneficial. When foliar deficiency symptoms are present, nutrient sprays usually are the quickest way to get nutrients into the tree. Under such conditions, foliar sprays function as a “Band-Aid” (or a tourniquet) to keep the tree functioning until soil fertilizers can be applied and the nutrient can be absorbed by the roots. Foliar sprays also can be the best way to get a nutrient into the tree at times when root growth or function is reduced.

Other nutrients such as zinc, copper, iron, boron, and manganese are needed in very small amounts by plants and consequently are referred to as “micronutrients.” Often, excess amounts of these nutrients can be toxic to plants. Foliar sprays can be an effective means of getting micronutrients into trees because they deliver a small, set amount of nutrient directly to the tree. Carefully measured and applied micronutrient sprays can help keep trees healthy and avoid toxic levels of these nutrients in the tree.

CAUTION! Foliar sprays can burn/damage tree tissue, including leaves, shoots, buds, **and fruit**. Therefore, use extreme care when deciding whether to use foliar materials between budbreak and harvest to avoid potential crop damage. A good general rule to follow is this: Between dormancy and harvest, avoid foliar feeds unless visible symptoms or lab analysis show a deficiency problem exists. In addition, use dilute sprays. Tissue damage usually occurs when concentrated materials are applied or sprays are concentrated by evaporation on the tissue.

The information presented here has been compiled from a review of information and research from both Washington and Oregon. Climatic and environmental differences between the Mid-Columbia region and other regions of the Pacific Northwest may require further work to determine the effectiveness of spray applications developed in other regions. If you are uncertain about how a particular material will work in a specific orchard, test the material, at the concentration recommended, on a few trees before spraying the entire orchard.

NOTE: Not all fertilizer materials are effective as foliar sprays. Severe tissue damage can occur as a result of foliar applications of some nutrient formulations that are not intended for foliar use. Use caution when applying foliar nutrient sprays between dormancy and harvest.

Nitrogen

Urea sprays are an effective means of getting nitrogen into fruit trees at certain times of the year. These sprays can cause fruit and/or leaf burn. Consequently, foliar urea applications are risky when fruit is present. Such applications should be made only when trees are obviously nitrogen deficient. The Washington spray guide warns against foliar urea application to pear and stone fruits, reporting that they can cause injury. Low urea concentrations should be used when spraying apple trees when crop is present.

In contrast, concentrated postharvest urea sprays have been shown to be very effective in getting nitrogen into pear and apple fruit buds. Oregon State University researchers Tim Righetti, Anita Azarenko, and David Sugar have shown that postharvest urea treatments increase the length of time that pear blossoms are receptive to pollen, and this may increase fruit set. Research has shown that 10% urea solutions (84 lb urea/100 gal water) badly burn leaves. Urea solutions of 5% (42 lb urea/100 gal water) have been shown to be effective without extreme leaf burn. However, some leaf burn is to be expected.

Unlike late-season soil nitrogen fertilization, postharvest foliar urea sprays do not seem to significantly increase chances of winter injury.

NOTE: 1) Biuret is a by-product of urea manufacture and is toxic to plants. To avoid tissue damage, check the label to make sure that the urea material contains **less than 2% biuret**.

2) If you tank-mix urea with other materials, it may increase or decrease the effectiveness of the other materials. Urea can reduce the effectiveness of some pesticides and increase the effect of some growth regulators. Urea improves leaf boron uptake, and is recommended as a tank mix for **postharvest** boron applications. Use caution when tank-mixing urea with other materials.

Boron

Boron deficiency can reduce fruit set and produce bark necrosis in apple as well as fruit cork. Fruit cracking is a symptom of boron deficiency. Although trees need boron, it also can be toxic to trees. Thus, both too little and too much boron are a problem in fruit trees. Also, because trees need only a small amount of boron, it is easy to overdo it, especially with soil fertilizer applications. Consequently, it may be best to apply annual foliar boron sprays instead of soil applications. This has been shown to be true in nonirrigated pear orchards, but the idea has not been tested elsewhere.

Tank-mixing urea with boron increases boron uptake in fall applications. As little as 8-9 pounds of urea per 100 gallons (1% urea solution) can be used to “carry” boron into the tree.

A number of new boron spray products have been developed in the past few years. Dr. Frank Peryea, WSU researcher at the Tree Fruit Research Center in Wenatchee, has done a great deal of work evaluating these new materials. The information that follows is from his work.

All boron products use either boric acid or sodium polyborate as the source of boron. Dr. Peryea has shown that significant differences in tank water pH can result from the use of different boron products. Sodium polyborate will increase the pH of spray tank water unless an acidifier is mixed with the product during manufacturing or in the spray tank. High tank water pH can degrade some pesticides (e.g., Guthion) or plant growth regulators (e.g., Promalin). Boric acid does not dissolve as quickly as sodium polyborate, but doesn't increase tank water pH. Pure boric acid may slightly decrease tank spray water pH. **Regardless of the boron product used, checking tank water pH when tank mixing with pH-sensitive products (such as Guthion or Promalin) is highly recommended.**

NOTE: High boron spray rates and concentrations can deliver excess boron, resulting in **shoot dieback or even tree death**.

Zinc

Zinc deficiencies can reduce leaf size, shoot growth, fruit set, and fruit size. In extreme cases, zinc deficiency shortens the distance between leaves, and new growth looks like a tuft or rosette formed on branch tips with smaller, sometimes yellowish leaves below. Soil applications are not effective on mature trees. Spray applications are effective, and annual spray applications are most effective.

Several materials are available as zinc foliar materials. Zinc sulfate is effective, but can damage leaves and fruit if concentrated spray material is applied. (Spray oil should not be applied within 30 days of zinc sulfate sprays.) Zinc chelate or organic complex materials also are effective in getting zinc into tree leaves. Some of these products are compatible with oil. Check the label to determine which materials should be used with oil.

Before buds open in the spring (no later than Stage 2) is the most effective time to apply foliar zinc. **Again, do not use zinc sulfate with oil or within 30 days of oil application.** Always check the label to determine whether oil is compatible with a particular zinc material.

Zinc-deficient trees can be treated with foliar sprays during the growing season. These applications can cause russetting in the spring when conditions often are cool and damp. Use low rates on bearing stone fruit. Avoid using zinc sulfate on bearing trees.

Fall foliar zinc applications can be made, but are not as effective as dormant applications. Unlike boron or urea, very little zinc moves out of the leaf before leaf fall. Consequently, after a fall zinc spray, the majority of fertilizer zinc stays in the leaf and ends up on the orchard floor after leaf fall. Some zinc does stay in the tree, but a recent study showed that less than 10% of the zinc in ‘Golden Delicious’ flower clusters was from fall foliar zinc spray applied the previous year. If you use zinc sulfate in the fall, remember that high rates of zinc sulfate

material can damage leaves and buds. Zinc chelate materials are less damaging.

Copper

Fruit trees need a very small amount of copper to avoid deficiency. Copper sulfate fungicide sprays are effective means of getting copper into trees.

NOTE: Copper sulfate can russet Anjou pears. Copper sprays applied to Bosc pears to induce russet may cause fruit cracking.

Magnesium

Magnesium deficiency symptoms have been reported in mature leaves of heavily cropping apple and pear trees. Soil applications of dolomitic limestone are an effective means of correcting magnesium deficiencies. In the case of severe magnesium deficiencies, several materials applied in two different sprays are reported effective.

Calcium

The relationship between calcium sprays, fruit calcium levels, and fruit physiological disorders has not been clearly established in the Mid-Columbia region. In warmer regions of the Pacific Northwest (Yakima, WA and Medford, OR), the use of calcium sprays has been correlated with a reduction in bitter pit (apples), cork spot and alfalfa greening (Anjou pears), or postharvest decay (Bosc pears). Research from Washington suggests that calcium chloride sprays on cherries can reduce fruit softening, postharvest injury, and minor rain cracking. These sprays also may reduce cherry size.

NOTE: Foliar calcium chloride applications can russet fruit. The use of concentrated sprays is most likely to mark fruit. Use of dilute calcium sprays and reduced rates are most likely to minimize or avoid leaf burn and fruit marking. Pears are more susceptible to calcium spray damage than apples. Avoid spraying under slow drying conditions (when material is gradually concentrated in local regions of the fruit) and when the temperature is above 80°F.

Spray program for nutrients

Application rates in these tables are for dilute sprays, generally estimated as 200 to 400 gal/A. Gallonage requirements vary depending on tree size, shape, and spray equipment. Information from *WSU Crop Protection Guide—Tree Fruits* series is included in the following section.

Nutrient	Possible materials or combinations	Amount per acre	Amount per 100 gallons** (dilute sprays)	Important notes
Dormant spray—apply in spring before buds open				
zinc maintenance	1. zinc chelate or organic complex			Follow the label.
	2. zinc sulfate 1.2LC	2-4 gal	0.5-1 gal	
	3. zinc sulfate 36% crystals	6-12 lb	1.5-3 lb	Make sure all crystals dissolve. See precautions in text.
	4. basic zinc sulfate (dry, 50-52%)	6-12 lb	2 lb (w/ oil) 3 lb (w/o oil)	Oil-free sprays are more effective. Follow label for oil sprays.
	5. basic zinc sulfate (liquid, 20-25%)			Follow manufacturer's label.
zinc deficiency	1. zinc chelate or organic complex			Follow the label.
	2. zinc sulfate 1.2LC	13 gal	3.25 gal	
	3. zinc sulfate 36% crystals	40 lb	10 lb	Make sure all crystals dissolve. See precautions in text.
	4. basic zinc sulfate (dry, 50-52%)	16 lb	4 lb	Apply without oil.
	5. basic zinc sulfate (liquid, 20-25%)	—	—	Follow manufacturer's label.
Prepink or pink spray				
boron maintenance*	1. boric acid (dry or liquid)			Apply amount equivalent to 0.5 lb actual boron per acre. For all products, prepink to pink or postharvest is preferred. See precautions in text.
	2. polyborate (dry or liquid)			
boron deficiency	1. boric acid (dry or liquid)			Apply amount equivalent to 1 lb actual boron per acre. For all products, prepink to pink or postharvest is preferred. See precautions in text.
	2. polyborate (dry or liquid)			
Foliage spray—after bloom and before harvest				
boron maintenance*	1. boric acid (dry or liquid)			Apply amount equivalent to 0.5 lb actual boron per acre. See precautions in text.
	2. polyborate (dry or liquid)			
boron deficiency	1. boric acid (dry or liquid)			Apply amount equivalent to 1 lb actual boron per acre. See precautions in text.
	2. polyborate (dry or liquid)			
calcium (cherry fruit firmness and reduced cracking)	1. calcium chloride	8-12 lb	2-3 lb	Limited effect and can reduce fruit size. Three or more applications are needed at weekly intervals prior to anticipated harvest. See text.
calcium (bitterpit of apple)	1. calcium chloride	8-12 lb	2-3 lb	Three to five applications needed from early June to late August. Can cause fruit injury. See text.

*In nonirrigated orchards in White Salmon-Underwood area, use the deficiency rate.

**Low concentrations, 400 gal/A, generally are recommended to prevent damage.

Spray program for nutrients (continued)

Nutrient	Possible materials or combinations	Amount per acre	Amount per 100 gallons** (dilute sprays)	Important notes
CONTINUED—Foliage spray—after bloom and before harvest				
calcium (alfalfa greening of pears, cork spot of Anjou pear)	1. calcium chloride	4 lb	0.5-1 lb	Apply in 400-800 gal/A depending on tree size. Four applications needed from June to August. Can cause fruit injury. See text.
magnesium deficiency	1. magnesium chelate or organic compound	40-80 lb	10-20 lb	For rates of magnesium chelate, see manufacturer's label.
	2. magnesium nitrate 13.5% crystals	20-40 lb	5-10 lb	Apply in June. Repeat in July if necessary. Do not apply after August 1.
	3. magnesium nitrate 0.4LC	6-12 gal	1.5-3 gal	
	4. calcium nitrate (fertilizer grade) + Epsom salts (magnesium sulfate)	24-48 lb	6-12 lb	
nitrogen deficiency	1. urea 46% solid	2-10 lb	0.5-2.5 lb	Apply only as needed to apples. Can cause injury on pear or stone fruits. See text.
	2. urea 20% liquid	0.5-2.4 gal	0.25-0.6 gal	
zinc deficiency, nonbearing trees	1. zinc sulfate 36% crystals	6 lb	1.5 lb	Make sure all crystals are dissolved. See precautions in text. Can cause injury, particularly on stone fruits. Follow the label. Follow manufacturer's label for all products. See precautions in text.
	2. zinc sulfate 1.2LC	2 gal	0.5 gal	
	3. basic zinc sulfate (dry, 50-52%)	6-12 lb	1.5-3 lb	
	4. basic zinc sulfate (liquid, 20-25%)			
	5. zinc chelate or organic complex			
zinc deficiency, bearing trees	1. zinc chelate or organic complex			See precautions in text. Can cause injury, particularly on stone fruits. Follow the label.
Postharvest spray—apply after harvest and while leaves are still green and active				
boron maintenance*	1. boric acid (dry or liquid)			Apply amount equivalent to 0.5 lb actual boron per acre. For all products, prepink to pink or postharvest is preferred. See precautions in text.
	2. polyborate (dry or liquid)			
boron deficiency	1. boric acid (dry or liquid)			Apply amount equivalent to 1 lb actual boron per acre. For all products, prepink to pink or postharvest is preferred. See precautions in text.
	2. Polyborate (dry or liquid)			
nitrogen maintenance	1. urea 46% solid	42 lb	42 lb	Do not apply more than 60 lb/A. Severe leaf burn can occur.
	2. urea 20% liquid	10 gal	10 gal	
zinc maintenance	1. zinc chelate or organic complex			Follow the label.
	2. zinc sulfate 36% crystals	6-12 lb	1.5-3 lb	Make sure all crystals dissolve. Do not apply before October 1. Do not apply on apricot. Follow manufacturer's label. See precautions in text.
	3. zinc sulfate 1.2LC	2-4 gal	0.5-1 gal	
	4. basic zinc sulfate (dry, 50-52%)	6-12 lb	1.5-3 lb	
	5. basic zinc sulfate (liquid, 20-25%)			
zinc deficiency	1. zinc sulfate 36% crystals	25 lb	6.25 lb	Make sure all crystals dissolve. Do not apply before October 1. Do not apply on apricot. Follow manufacturer's label. See precautions in text.
	2. zinc sulfate 1.2LC	8 gal	2 gal	
	3. basic zinc sulfate (dry, 50-52%)	16 lb	4 lb	
	4. basic zinc sulfate (liquid, 20-25%)			
	5. zinc chelate or organic complex			

*In nonirrigated orchards in White Salmon-Underwood area, use the deficiency rate.

**Low concentrations, 400 gal/A, generally are recommended to prevent damage.

Growth regulator sprays

In recent years, local research with plant growth regulators has been limited. Washington State University (WSU) has had an ongoing research program with plant growth regulators. **Current information on the use of plant growth regulator materials is available in the *WSU Crop Protection Guide—Tree Fruit (EB 0419)* at <http://cru.cahe.wsu.edu/CEPublications/eb0419/eb0419.pdf>.** Because there may be differences in product registration between Oregon and Washington, check with your chemical supplier or local Extension office to make sure that a specific product is labeled for use in Oregon. Local experience with these materials suggests the precautions listed below in addition to those included in the WSU Guide.

Chemical thinning sprays

Results with thinning sprays may be quite variable. This often is due to variations in the weather preceding and following spray applications. The rate of application of all thinning sprays should be 400–600 gallons per acre. Concentrations greater than 2X should be avoided. Best results have been obtained with high gallonages of water per acre. Inconsistent results have been obtained when growth regulators are applied in concentrate sprays.

Chemical thinning sprays for apples

1. Apply carbaryl (Sevin) as a thinning spray 15 to 25 days after bloom. Apply NAA as a thinning spray 14 to 18 days after bloom. Twenty days after bloom is optimum. During cool springs when growth is slow, fruit size is a better guide for timing sprays than days from full bloom. Ideal time is when fruit is 10–15 mm in diameter.
2. Combinations of carbaryl plus NAA will give increased thinning.
3. A wetting agent must be added to an NAA spray. Use 0.66 pint of Regulaid (a nonionic, water-soluble spreader) per 100 gallons of water when NAA is used alone. Use 0.5 pint of Regulaid per 100 gallons of water when carbaryl plus NAA is used.
4. Carbaryl provides 2 weeks protection against codling moth when used at 1.5 pints per 100 gallons of water. Carbaryl may thin if used in the first cover.
5. Carbaryl is injurious to bees; mow cover crops that are in bloom before applying carbaryl 50WP.
6. Carbaryl may over-thin young trees that have not reached full bearing capacity or that are in solid block plantings with no pollinizers.
7. The total effect of a carbaryl thinning spray cannot be evaluated for 3–4 weeks.
8. Carbaryl *may increase numbers of misshapen fruits that must be hand thinned and may russet Golden, particularly in low spots.*
9. To determine the parts per million spray concentrate (ppm) in 100 gallons of spray, remember that—
1 fluid ounce of 50 gram material = 1 ppm
0.25 fluid ounce of 200 gram material = 1 ppm
10. NAD plus ethephon gives greater thinning and return bloom.

Chemical thinning sprays for pears

1. USE 10 PPM NAA RATE IF TREES ARE WEAK. HIGHER RATES POSSIBLY CAUSE ADVANCED MATURITY.
2. Apply 14–18 days after bloom.
3. In solid Bartlett blocks, use the lower rates.
4. Avoid spraying other pear varieties in same block.
5. If weather is very cool, delay application until 21 days following full bloom.
6. Do not use this program in young orchards.
7. Do not use NAA in concentrate sprays. Use in dilute sprays.

Stop drop sprays

Naphthalene acetic acid (NAA) is the material usually used as a hormone spray for the control of fruit drop in Hood River County. Stop drop sprays should be applied 6 to 8 days prior to harvest (not less than 5 days). Commercial solutions of Naphthalene acetic acid vary in the amount of actual NAA. The recommended rate will depend on the concentration of active ingredient in a specific product. Use of NAA as a stop drop spray for d'Anjou pear is permitted under a special local need registration (Section 24(c) FIFRA) through December 2009.

Retain (AVG) was registered for use on apples and pears in 1997. Consult your fieldman regarding local experience with this product.

Plant growth regulator for apples

Apogee was registered for use on apples in 2000. Consult your fieldman regarding local experience with this product.

Plant growth regulator for cherries

1. Benefits of gibberellic acid (GA) application 3 weeks prior to normal anticipated harvest include delay in maturity of 2 to 5 days. Other effects that can be expected are firmer and larger fruit and possible increases in susceptibility to rain cracking. Benefits may not be realized on trees with heavy fruit loads.
2. For Lambert, use lower rates (10–15 ppm) except on heavy fruit set, when a higher rate can be used.
3. The effects of GA applications on recently introduced cherry varieties may be different than on standard varieties. Proceed with caution.

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We wish to acknowledge Mike Bush, Bruce Decker, Jeff Heater, and Jeff McNerney for help in reviewing this guide.

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Revised January 2008.