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*1983 Pest Management Guide for*

# **Filberts and Walnuts**

*in Oregon*



OREGON STATE UNIVERSITY EXTENSION SERVICE

## Health Hazards

Each season there are accidents, and in some years deaths, attributable to the misuses of pesticides. In cases of accidents involving toxic pesticides see your doctor at once. Your doctor may call one of the Consultation or poison Control Centers listed below.

### Ask for Poison Control

These centers maintain up-to-date files on all agricultural chemicals and other poisons. The service is available to professional persons only. A pediatric resident staffs the Center 24 hours a day.

## OREGON

Good Samaritan Hospital  
3600 Samaritan Drive  
Corvallis, Oregon 97330  
Phone: (503) 754-2922

Oregon Poison Control and Drug Information Center  
University of Oregon Health Sciences Center  
3181 S. W. Sam Jackson Park Rd.  
Portland, Oregon 97201  
Phone: (503) 225-8968  
Oregon Toll Free 1-(800) 452-7165

Bay Area Hospital  
1775 Thompson Rd.  
Coos Bay, Oregon 97420  
(503) 269-8166 or  
269-8169

Advice can also be obtained at—

## WASHINGTON

Environmental Protection Agency  
Field Study Section  
Wenatchee, Washington 98801  
P. O. Box 219  
Phone (509) 662-4243

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## Use Pesticides Safely

For safe use of pesticides, read the label on each pesticide container before each use, then follow the directions. If you are in doubt after reading the label, contact some qualified person such as your county Extension agent, fieldman, or chemical company representative to help evaluate the hazard of the chemical. Handle all pesticides with care. Even the most hazardous can be used with safety provided that recommended safety precautions are followed. Many of the materials mentioned in this circular are dangerous poisons and require careful handling. The organic phosphate insecticides—demeton (Systox), Guthion, and parathion—are extremely poisonous and require a special warning.

Malathion and diazinon are also organic phosphate insecticides, but are less hazardous than the others listed above. However, these compounds also should be used with caution. Ingestion of any of these compounds may be fatal.

### Watch for these symptoms

The initial symptoms of organic phosphate poisoning (i.e. parathion) are giddiness, headache, nausea, vomiting, excessive sweating, and tightness of the chest. These are followed by or accompanied by blurring of vision, diarrhea, excessive salivation, watering of the eyes, twitching of muscles (especially in the eyelids), and mental confusion. One of the most characteristic signs is constriction of the pupils, but this may be preceded by dilation. Late signs are fluid in the chest, convulsions, coma, loss of urinary or bowel control, and respiratory failure. Repeated exposures to these compounds may increase susceptibility to poisoning, even without symptoms.

The symptoms of poisoning by chlorinated hydrocarbon insecticides, such as Thiodan and endrin, are primarily due to their effect on the nervous system and include hyperexcitability, tremors, and convulsions. General symptoms are malaise, headache, fatigue, and possible lack of appetite and weight loss.

Frequent symptoms and signs from inhalation of pyrethroids, such as fenvalerate (Pydrin) and permethrin (Ambush, Pounce) are a stuffy, runny nose and scratchy throat. Asthmatic wheezing may also be induced by exposure of susceptible individuals.

### Take these precautions

1. If you plan to apply any of the more dangerous pesticides, make sure you and your physician know the types of compounds you are using. If you anticipate using the more toxic organic phosphate materials, your physician may suggest that you have a pre-seasonal blood test to determine your normal cholinesterase activity level and suggest periodic cholinesterase tests during the spray season. He will then be in a better position to deal with a sudden illness. If he should provide you with a supply of atropine tablets for organic phosphate poisoning, make sure he gives you directions for their use. Do not take them before definite symptoms occur. If you ever take atropine tablets, call your physician as soon afterward as possible. Do not resume flying or operating ground equipment after taking atropine. Any person who is ill enough to receive a single dose of atropine tablets, should be kept under medical observation for at least 24 hours, because atropine may produce only temporary relief of symptoms in what may prove to be a serious case of poisoning. Keep atropine tablets away from children. An antidote for treating organic phosphate poisoning, pralidoxime chloride (2 PAM), available as Protopam Chloride, Ayerst Laboratories, has proved to be a valuable supplement to atropine in the treatment of severe and moderately severe cases of organic phosphate poisoning. It is available to physicians and hospitals through regular pharmaceutical channels.

2. Wear protective clothing, preferably water repellent, while spraying hazardous materials. Toxic pesticides can be absorbed into the body through the skin. Immediately rinse off thoroughly with soap and water any chemical accidentally coming in contact with your body. Make sure gloves, boots, and clothing are free from rips, tears, and worn areas, as pesticides entering through these areas are trapped against the skin, causing an extremely dangerous situation. Rubber gloves should be tied off, if possible, near the tops during mixing and spraying to prevent accidental pesticide entry. Change and launder clothing and bathe daily.

3. Wear a respirator mask when loading or mixing wettable powders or when applying dusts. *The respirator should be approved for the materials in question by the National Institute for Occupational Safety and Health (NIOSH) or the Mining Enforcement and Safety Administration (MESA).* If specific respirator brand or model is in question, consult the Oregon Insect Control Handbook for verification. Wear an approved respirator whenever the more volatile of the toxic compounds are being used, especially parathion and Phosdrin. Change the filters and pads at regular intervals.

4. Paper bags, cardboard boxes, and plastic containers should be burned after making sure that smoke does not drift over nearby homes, people, livestock, and the person doing the burning. Pouring used crankcase oil over the containers before lighting them will aid combustion. Rinse metal or glass containers with water at least three times upon emptying, with the rinse water being added to the spray tank. This practice prevents wastage and hazardous residues that may remain in the container. Break glass jars and crush or punch metal containers with holes for permanent disposal. Wear protective safety goggles to protect the eyes against splashing materials during mixing and application. Never measure or leave mixtures of insecticides in beverage bottles or in labeled cans or boxes that have formerly contained food products. Tragic, preventable poisonings occur when children get hold of "empty" pesticide containers or obtain food containers filled with insecticide.

5. Keep your pesticide storage shed or room locked.

6. Do not eat, drink, smoke, or chew tobacco while handling, mixing, or spraying pesticides.

7. Always use pesticides according to directions and apply at the recommended rate.

8. Experience shows that poisoning occurs most often in hot weather. Spray with the more toxic materials during cooler periods when possible. Be extremely careful when spraying during periods of high temperatures.

9. Apple thinners and others have been poisoned by working in orchards treated with parathion less than 48 hours earlier. Therefore, it is advisable to wait longer than 48 hours before beginning work in treated orchards. If possible, wait a week.

10. Bury spilled pesticide and wash the contaminated area with soap and lots of water. The breakdown of these insecticides can be sped up by using a weak lye solution.

11. Cover crops treated with most pesticides should not be used as pasture or fed to livestock.

12. Do not feed pesticide-contaminated apple or pear pomace to livestock.

13. There have been a number of cases of irritation of skin, eyes, and respiratory tract from the use of ziram. These cases have occurred to sprayers from direct contact with the materials and to thinners and pickers whose only exposure was to residues on fruit.

14. Agricultural workers should avoid eating unwashed chemically treated fruit and vegetables in the field. The time limitations from application to harvest have been established to protect the consumer from harmful residues. Disregard of these limitations presents a special hazard to the pickers, growers, and field workers.

15. Avoid pesticide drift to non-target areas and organisms. Although drift within the orchard is beneficial in that it aids pesticide distribution on and among trees to the pest organisms, drift from the orchard can be both wasteful and hazardous. Take the proper precautions to minimize spray drift by observing the following:

Calibrate spray application equipment accurately.

Coarse spray droplets do not drift as far as fine ones; use the coarsest spray that will give effective and economic coverage.

High wind velocities create hazards by making drift control impossible.

Very high temperatures and temperature inversions impair and can prevent pesticides from settling to the trees and ground within the treatment area.

Downhill air movement in the early morning on a calm day can carry spray a considerable distance from the target area.

## What to do for poisoning

1. In severe cases or organic phosphate poisoning, breathing may stop. In such a situation, *artificial respiration is the most important first aid until breathing has resumed.*
2. Get the patient to a hospital or physician as soon as possible. Give artificial respiration on the way if the patient turns blue or stops breathing. If you know which pesticide may be involved, *take along a label for the doctor's information.* If the label cannot be removed easily, carefully take along the entire pesticide container.
3. Never try to give anything by mouth to an unconscious patient.
4. If a pesticide has been splashed into your mouth or swallowed, immediately rinse your mouth with plenty of water. It is sometimes dangerous to cause vomiting after swallowing certain pesticides, it is therefore, very important to have first read and understood the label directions for this situation. If vomiting is recommended, induce it by giving a tablespoon of salt dissolved in one-half glass of warm water. If the person is a child, induce vomiting by stimulating throat with blunt end of a spoonhandle—keeping head in an inverted position.
5. Where excessive amounts of the pesticide, especially in concentrate form, have come into contact with the skin, immediately remove all clothing and bathe with generous amounts of soap and water, rinsing thoroughly.
6. If the eyes have been contaminated with spray, especially with insecticide concentrate, flush them immediately with copious amounts of water, preferably with running or flowing water, and immediately consult a physician.
7. Lie down and keep warm.

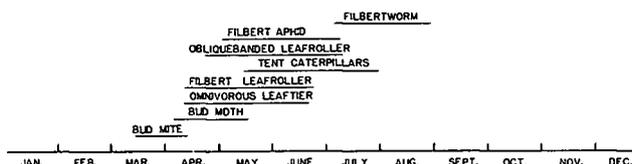
In case of accidents involving toxic pesticides see your doctor at once.

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This warning statement was prepared with the assistance of staff members of the Office of Research and Monitoring, Environmental Protection Agency, Wenatchee, Washington and the Occupational Health Section, State Board of Health, Portland, Oregon.

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## Filbert Insect Pest Seasonal Activity



## Filbert insect pests

### Filbert Aphid

The filbert aphid is a small, light green aphid that feeds on the undersides of the leaves. Large populations can reduce nut size and percent fill. It may be necessary to control filbert aphids every year, as their damage is cumulative.

Filbert aphids overwinter as dark eggs attached to the twigs. Newly hatched aphids begin feeding in March on the unfolded leaves. Leaves become stunted and twisted. Sticky honeydew with grey sooty mold appears on the leaves and branches. Usually insecticide control of the filbert aphid and leafroller can be combined using either diazinon, Guthion, Thiodan, or Zolone. Metasystox-R can be used for aphids.

### Big Bud Mite

The big bud mite is a small (not visible to the eye without magnification) eriophyid mite. Bud mites feed on leaf and flower buds as well as catkins. Infested buds become very large and the fruit buds do not produce nuts. These mites overwinter as adults and become active in the early spring. The loose bud varieties, such as Daviana and Royal are more susceptible to damage than the tight

bud varieties such as Barcellona. Timing of application is very important. Thiodan sprays are directed at mites moving from their overwintering sites on the bark to the expanding buds. This usually occurs in early spring (late March or April).

### Eyespotted Bud Moth

The larvae of the eyespotted bud moth are active in the early spring. They are small, chocolate brown caterpillars with black heads. They overwinter on the bark as larvae and begin feeding on buds early in the spring. They damage buds just before and during opening and can be particularly destructive to young trees. The bud moth has a wide host range, and can occur on apples, pears, plums, cherries, and peaches. The edge of a developing leaf is rolled into a tube that is sparsely lined with silk in which the caterpillar lives. It goes out at night to feed on leaves. The larvae feed for 1½ to 2 months. The moths emerge in the summertime and deposit single eggs or small clusters of eggs on the leaves. These eggs hatch and the larvae feed for a period of time on the leaves before they go into hibernation on the twigs or limbs of the tree. There is one generation a year. Diazinon, malathion, or parathion, applied when the larvae first become active in the spring, give good control.

### Filbert Leafroller

The filbert leafroller overwinters as an egg on the bark of the tree. Egg masses are conspicuous, white, about half the size of a dime, and commonly plastered on the lower scaffold limbs and trunks of trees. An egg mass may contain as many as 50 eggs. Eggs usually hatch in early April. The larvae feed on the expanding leaves but most damage is done to the young fruit buds, which may be chewed into or cut off entirely. Heavy infestations reduce nut yields. Mature larvae pupate in rolled up leaves and emerge as moths during the latter part of June or in July. Eggs are deposited at that time and these overwinter to produce larvae the following spring. There is one generation per year. Insecticide sprays are applied to control the newly emerged larvae. Thiodan, Sevin, diazinon, Guthion, Zolone, or *Bacillus thuringiensis*, a bacterial insecticide, have been used for control. Diazinon, Thiodan, Zolone, or Guthion will also control the filbert aphid so that a well timed single application of either insecticide may control both pests.

### Filbertworm

This is the most important pest of filberts. Filbertworms overwinter as pupae in the soil. Adult moths may fly as early as the first week in July. Emergence, however, may continue through mid-September. Egg laying begins soon after emergence, especially during periods of warm weather. Eggs are laid singly on the leaves and developing nuts, hatching about 8 days later. The young larvae crawl over a developing filbert between the shell of the nut and the husk. When the basal scar of the filbert is reached, the larvae tunnel into the nut to feed on the meat. Feeding may last for 2 to 3 weeks. Some larvae leave the nut when full grown, others remain in the nut until after harvest. Insecticide sprays should be made about a week or two after the first filbert moth is detected, especially if warm, clear weather follows. This may be from mid-July to mid-August. However, cold, rainy weather may delay the majority of moths from emerging for as much as 14 to 20 days. A second application usually is made 3 to 4 weeks later. If rains occur after an insecticide spray, another application will be necessary. Guthion and Pydrin have given good control of filbertworm. Sevin, diazinon, and Zolone are also registered.

### Twospotted Spider mite

Spider mites seldom if ever require chemical control on filbert trees in the Willamette Valley. During hot, dry summers large populations may build up, however, and cause damage in the form of sap removal from leaves and premature defoliation. Silvered, dry, and stippled leaves with webbing on the undersides are indicators of a spider mite infestation.

Spider mites overwinter as adults on the ground and under bark scales of trees. The two-spotted spider mite varies from cream colored to green colored and has two dark spots on its back. In late March and April, these mites move into the trees and settle on the leaves in the centers and tops of the trees, and this is where the heaviest populations occur. Hot, dry weather favors rapid reproduction, and consequently the largest numbers of these mites are found during July and August.

Orchards without cover crops may experience mite problems. If orchards are in a clean cultivation program, broadleaf weed control, minimum disking to reduce dust, and proper irrigation help to reduce mite problems.

Kelthane is registered for control of mites on filberts.

#### Obliquebanded Leafroller

The adults of OBLR are reddish brown in color with two oblique bands on the forewings. The wingspread is about 1 inch. The length of the wings folded over the back varies from 7/16 to 3/8 of an inch. The eggs are light green and shingled so that they overlap each other like fish scales. Upon hatching, the larvae are lemon yellow with black heads. As the larvae grow, they progressively change in coloration from grey to dark green. Full grown larvae measure about 1 inch long. The pupae are dark, reddish brown and are usually located in the folded leaves.

The obliquebanded leafroller is a relatively new pest on filberts. It was first observed causing noticeable damage on filberts in 1973 near Salem, Oregon. Since then it has become a secondary pest of filberts throughout much of the filbert producing region. The larvae feed on the foliage of a number of crops, including many trees and small fruits such as apples, pears, peaches, prunes, strawberries, and raspberries.

The insect overwinters as an inactive and partially grown larva that passes the winter in the cracks and crevices of filbert tree bark. In the spring as the temperature warms, the larvae become active and feed on buds and foliage prior to pupation. Pupation occurs usually on the leaves of the foliage and this period lasts from 4 to 6 weeks. Adults begin to emerge from early June through the middle of July. A sharp peak of emergence occurs near the middle of July. Egg laying begins a few days after adult emergence. Eggs hatch within 2 weeks and young larvae usually can be found in orchards by the first week of July. Damage is evident by mid-July. The larvae feed and develop for 6 to 8 weeks depending on the temperature. Pupation occurs inside silk webs and the adults of the second generation emerge in 1 to 2 weeks. The second generation adults usually emerge from the 1st week of September through early October. Eggs laid by these adults hatch in 7 to 10 days and the larvae feed for a brief period of time. They then cease feeding and are dormant until next spring.

Larvae feed on leaves, but their primary damage is from feeding on the nut shell underneath the husk. This feeding causes scarring and staining of immature nuts and results in premature drop. Also, some of the infested nuts do not mature and are consequently unmarketable. In some heavily infested orchards, the damage caused by this insect can be as serious as that of filbertworms. Up to 30 percent nut drop has resulted from this pest.

Infestations of larvae can be detected by periodic examination of filbert clusters starting in early June. Inspect nut clusters for damage. Brown rot infested clusters should be examined more closely to determine whether or not any webbing and larval feeding damage is visible. Some recent studies indicate that many nuts presumed to be infested by brown rot organisms were infested by OBLR larvae. Adults can be detected by pheromone traps. Use these traps to determine emergence dates and population levels of OBLR. Place traps in the orchard around the end of May and monitor twice a week for 2 months. Although no definite relations have been established between moths trapped and the damage at harvest, trap catches of more than 10 moths per week per trap may result in considerable damage. The pheromone traps also can be used to determine proper timing for insecticide application. Farmcraft and Wilbur Ellis supply these traps. Other chemical distributors may stock these traps in your area. Guthion, diazinon and Pydrin have given good control if applied as full cover sprays directed at controlling the young larvae. Sevin also controls this leafroller, but its use can result in the resurgence of large aphid populations.

#### Omnivorous Leaf-tier

Omnivorous leaf-tiers overwinter as eggs on many different trees in the Willamette Valley. In April and May the larvae hatch and are carried by the wind into and within fields and orchards on silken threads. The larvae feed on developing buds, leaves, and flowers of many different plants, including filberts, from May through July, and then pupate. The moths fly from July through August and deposit eggs on the bark of trees. There is one generation per year. Damage may be particularly severe to young trees. Pydrin, Sevin or Guthion, applied when the larvae are small, have given good control.

#### Scale

Scales seldom require chemical control on filbert trees. They appear as brownish to reddish bumps on limbs and twigs. These scales overwinter on twigs in a half grown condition. In the spring, summer, and fall, they suck plant juices. This causes stunting and dieback of twigs and small branches terminal to the scales. Heavy infestations can affect yield and quality of nuts, as well as greatly reduce the vigor of the trees. Dormant oil applications, either alone or with an organophosphate insecticide in either December or March, are effective in controlling scales. The crawlers or young, mobile scales that occur in July and August are usually controlled with the filbertworm cover spray.

#### Tent Caterpillars

Tent caterpillars overwinter as grayish egg masses plastered around small twigs of trees. The egg mass is about the size of a small mothball. Small caterpillars hatch from the eggs in the spring when the first leaves appear. They are brown, blue, or orange in color and live and feed in large numbers in silken tents. Entire limbs may be completely defoliated. The larvae pupate on the tree and produce moths that appear in midsummer. The caterpillars are easy to control. Best results are obtained when an insecticide is applied to the very small larvae. Sevin, *Bacillus thuringiensis*, and many organophosphate insecticides are effective in controlling tent caterpillars if applied to the small larvae.

### Filbert diseases

#### Filbert Bacterial Blight

Caused by *Xanthomonas corylina*, a bacterium. The organism attacks the buds, leaves, branches, and trunk. Occasionally it attacks the nuts, but seldom invades the roots. The most serious phase of the disease is trunk girdling and killing of trees up to 4 years of age.

Small, angular, or round, yellowish-green, water-soaked spots develop on the leaves, later turning reddish-brown. The first infections on current season's stems consist of dark green, water-soaked areas on the bark, turning reddish-brown. Such lesions may girdle the stems and cause them to die. Dead leaves often cling to girdled stems for a long period. One- and two-year-old twigs are also attacked and killed, infection taking place indirectly through wounds or by the invasion of the bacteria from blighted buds and shoots of current season growth. Cankers develop on the young tree trunks and are serious, as they may girdle and kill trees up to 4 years old.

#### Control:

1. New infection may be from diseased nursery stock or blight may be spread by cultural operations and rain.
2. Sterilize pruning tools in 70 percent denatured (rubbing) alcohol. Sponge exposed surfaces with sterilizing solution. Disinfect pruners "between trees."
3. Control Program—Sprays—apply bordeaux 6-3-100 or tri-basic copper sulfate, 6 pounds per 100 gallons of water or Kocide 101 4 to 6 pounds per 100 gallons of water, in late August or early September (before the first heavy fall rains). In seasons of heavy rainfall during fall and winter apply another spray when three-fourth of the leaves have dropped. A good wetting and sticking agent will increase the effectiveness of these spray mixtures.

Dusts—apply (1) August, (2) when half of the leaves have dropped, (3) if fall unusually wet, apply third application when most of the leaves have dropped. Apply dusts when trees are wet with dew.

Dust composition—25 percent monohydrated copper sulfate, 50 percent hydrated lime, 21.5 percent talc, 2 percent bentonite, and 1.5 percent light mineral oil. Apply 30-40 lbs. per acre.

#### Eastern Filbert Blight

Caused by *Anisogramma anomala*, a fungus. The disease has been found in Clark and Cowlitz counties in Washington and in two orchards in Columbia county, Oregon. The fungus attacks stems and twigs of the cultivated European filbert grown in the Pacific Northwest as well as the wild American hazel of the eastern United States. It has not been reported present on the wild beaked hazel of the Pacific Coast. Eastern filbert blight is caused by the canker producing fungus, *Anisogramma anomala*, whose windblown and rain-splashed spores initially enter the tree in the winter and spring through buds damaged and blasted open by the big bud mite. After

the spore enters the bud, it takes from 14 to 16 months before a canker becomes visible in the twig directly below the bud. The spore producing pustules of the fungus break out in lines throughout the canker and release new spores during the winter and spring rains, thus completing the life cycle. The canker continues to spread down the stem each year, later moves into the large limbs, and eventually reaches the trunk, whereupon death of the tree may soon follow.

The fungus attacks the new twigs first, but later involves the large limbs. Eventually most of the tree above the soil line is killed. Suckers and shoots near pruning cuts seem to be most susceptible. The pollenizer variety Daviana is the most susceptible and may be the first trees in an orchard to show symptoms. Barcelona and Duchilly are much less susceptible. The fungus infects the bark, which turns dark. Twigs and branches become girdled, and the leaves beyond the infected area may wither. At this point symptoms are similar to those caused by most canker-producing organisms. Later, the spore-producing pustules of the fungus break out in lines through the dead bark. Pustules are round or oval, distinctly raised above the surface of the bark. Each pustule is about 1/8 inch wide and 1/4 to 1/2 inch long, appearing in almost straight rows, lengthwise along the branch.

#### **Control:**

1. Prune and burn diseased branches.
2. Tests with bordeaux 12-12-100 and Kocide 101, 6 pounds per 100 gallons of water applied in November/December and again prior to March 1 have significantly reduced the number of cankers.
3. Control of big bud mites will aid in reducing the incidence of the disease.

## **Walnut insect pests**

### **Walnut Aphid**

Walnut aphids are small, yellow aphids that feed in large numbers on the undersides of leaves. They overwinter as shiny black eggs on twigs, leaf scars, and other roughened areas of the limbs. The eggs hatch in the spring and the young aphids colonize the new growth. Aphids feed near mid-ribs of the leaflets and on the veins radiating from them. Large populations of the walnut aphid may damage walnut trees seriously by decreasing leaf size and reducing tree vigor. It is also possible that a toxic substance is injected into the leaf tissues during the feeding process. Both quantity and quality of nuts are affected. Leaves may drop prematurely. However, aphid control is not always necessary in the Willamette Valley. Look for this aphid in June and July. Malathion, diazinon, or Zolone control this aphid as well as the duskyveined walnut aphid.

### **Duskyveined Walnut Aphid**

The duskyveined walnut aphid is larger than the common walnut aphid and feeds on the upper surface of the walnut leaf. The aphids characteristically line up on either side of the mid-rib. The seasonal life history is similar to that of the walnut aphid. This aphid causes a shriveling of the walnut leaves and causes the mid-ribs of the infested leaflets to appear black. Check for this aphid in June and July too.

### **Fall Webworm**

Fall webworms are pale yellow to brown caterpillars with yellow stripes. They live in groups in silk tents on the limbs of trees and may defoliate entire branches. These larvae appear in late summer, unlike tent caterpillars, which occur in the spring. The full-grown larvae are about 1 inch long and pupate in brown cocoons, usually attached to the tree trunks. The adults have white wings with black spots, and their abdomens are yellow with black spots. The adults appear in June or July and lay large masses of white or yellow eggs on the undersides of leaves.

Webworms are easily controlled. However, insecticides should be applied early before the silken tents are formed. A complicating factor on large walnut trees is that the webs often occur on the upper branches of the tree. Look for webworms in late July, August, and September. Diazinon gives good control.

### **Scales**

Scale insects such as the frosted scale or the calico scale are oval, rich brown to blackish in color at maturity, and may be as much as 1/4 inch in diameter. In June and July small scales that are mobile

(crawlers) hatch from eggs underneath the waxy covering of old female scales on twigs. These crawlers leave the protective cover of the mother scale and migrate to the leaves, leaf petioles, and the current season's twig growth. Here they settle (mostly on the lower surfaces) to feed on the leaf sap. Development occurs through the summer. With the approach of winter, the scales molt (remove their skins) and move back to new twig growth before the leaves fall. As winter approaches, they molt again and during this period the frosted scales cover themselves with a powdery white wax, hence, the name frosted scale.

Scales damage trees only when in large numbers, such as when they completely cake the twig. Then tree vigor is impaired and injury results. Large populations of scales reduce the vigor of trees and lower the size and quality of the nut crop. If scales are a problem, control is best achieved in June and July when the crawlers first appear on the leaves. These are very small and are the most susceptible stage for control with insecticides. Diazinon is effective.

### **Walnut Husk Fly**

The walnut husk fly is one of the most important insect pests of walnuts in Oregon. The larvae feed on the husks of the developing nuts. This causes shell staining and may darken the kernels. The feeding process also damages the conductive tissues of nuts, causing the kernels to shrivel. Infested husks are blackened and soft, and the white maggots usually can be found just under the husk. The damage superficially resembles walnut blight, but walnut blight produces hard, roughened, sunken, and cracked husks. This is in contrast to soft and mushy husks produced by the husk fly.

Husk flies overwinter in the soil under trees. The adults emerge in the north Willamette Valley from mid-June through the first week in August. In the Dundee area, husk flies emerge from July 25th through September 10th. The adult flies are the size of houseflies, brown, and have yellow circles on their backs. The wings are marked with dusky brownish bars. The female flies usually spend 2 to 3 weeks on the foliage before they mate and begin laying eggs. The female fly deposits eggs within the husk of the walnut. These eggs hatch within 7 days and the resulting larvae feed for about 5 weeks on the husks before dropping to the ground to pupate. Control is directed at the adult flies before egg laying occurs. The insecticides used do not kill the eggs or maggots, which are under the walnut husk. Insecticides applied within 14 days after the first husk flies emerge are effective in controlling this pest. However, complete coverage is necessary, which is often difficult on large trees. Recently, Zolone has given the best control of the husk fly in commercial groves. Additional applications may be necessary if rain occurs within a week of the first spray, and/or if adult fly emergence extends over a long period of time.

Sticky traps are available to detect emerging husk flies. These are useful in determining if and when to apply an insecticide. See also OSU Extension Fact Sheet 168, "The Walnut Husk Fly," for further information on its life history, detection, and control.

## **Walnut diseases**

### **Walnut Blight**

Caused by *Xanthomonas juglandis*, a bacterium. The bacterium overwinters on infected buds and to a lesser extent in holdover cankers on twigs of the previous year's growth. During the early spring growth period, bacteria are spread by rain drip from these sources to current growth. Frequent and prolonged rains, just before and during bloom and for about 2 weeks thereafter, result in severe blight outbreaks. This is the time when the nuts are most susceptible.

The Howe variety seems to possess inherent resistance to blight in Oregon. The infection appears first on the leaves as reddish-brown spots, on the stems as black slightly depressed spots often girdling the shoots. Young leaf and catkin buds infected with blight turn dark brown or black and soon die. The disease is serious and destructive on the nuts, where it causes black, slimy spots of varying sizes. The organism penetrates the husk, the shell, and occasionally the edible meat.

#### **Control**

#### **Sprays**

1. Early prebloom stage: bordeaux mixture 4-2-100 plus 1 pint summer oil emulsion, or 2 pounds Kocide 101 plus 8 ounces su-

preme or superior type oil per 100 gallons water, or tribasic copper sulfate (approximately 50 percent copper content at the rate of 3 pounds in 100 gallons of water; add a good spreader-sticker.

2. Late prebloom stage—repeat 1 above.

3. Early postbloom stage—bordeaux 4-2-100, or Kocide 101, or tribasic copper sulfate—same as early and late prebloom applications.

#### Dusts

(Apply first two applications at the rate of 1.5 pounds of dust per tree; thereafter, 1.75 pounds per tree.)

1. Early prebloom stage: Copper plus lime plus sulfur plus oil dust composed of 15 percent monohydrated copper sulfate, 30 percent hydrated lime, 10 percent dusting sulfur, 41.5 percent talc, 2 percent bentonite and 1.5 percent light mineral oil.

2. One week after Application 1: Same as Application 1.

3. One week after Application 2: Same as Application 1.

4. One week after Application 3: Same as Application 1.

5. One week after Application 4: Same as Application 1.

6. One week after Application 5: Same as Application 1.

#### Walnut Blotch

Caused by a fungus, *Gnomonia leptostyla* (imperfect, *Marssonina juglandis*). In recent years the disease has been occurring frequently and has caused severe defoliation, especially in the Adams variety.

The disease occurs on the leaves, young shoots, and nuts. On the leaves it produces numerous, circular to irregularly circular, reddish brown to grayish brown spots from 1/16 to 3/4 inch in diameter. On stems of shoots of current season growth, the lesions appear as oval to irregularly circular, sunken, light grayish brown

dead areas with dark reddish brown margins. Summer fruiting bodies (acervuli) of the causal fungus are generally borne in abundance on twig lesions. Blotch is most serious and destructive on the nuts, where it causes depressed, circular to irregularly circular, dead spots in the husk, not quite as large as those on the leaves. If infection occurs when the nut is very young, it does not develop normally and often drops to the ground prematurely. If the disease is severe, a serious reduction in yield may occur.

The causal fungus overwinters in old, infected leaves and nuts on the ground and in cankers on twigs of the preceding year's growth. During rainy periods in the spring, the spores (ascospores) are forcibly ejected from fruiting bodies of another type (perithecia) which develop in the old diseased leaves and nuts, and are carried by air currents to the new growth, where they induce primary infection. Spores produced in acervuli in old twig lesions are also a source of primary infection. Successive generations of summer spores borne in primary and secondary lesions subsequently spread the disease.

#### Control

No experiments for the control of this disease have been conducted in the Northwest, but the following spray program should provide some control.

Apply bordeaux 4-2-100 plus 1 pint summer oil emulsion or Kocide 101 2 pounds plus 8 ounces supreme or superior type oil/100 gallons of water or tribasic copper sulfate, 3 pounds in 100 gallons of water, plus spreader sticker:

1. When leaves are unfolding.
2. When leaves are full sized.
3. Two weeks later.

## FILBERT SPRAY GUIDE

Pest or disease	Material (see footnote 1, page 10)	Amt. of product/acre	Remarks; interval between last application and harvest
<b>DECEMBER or MARCH (when trees are dormant)</b>			
Scale (if a problem)	supreme or superior type oil + diazinon 50 WP	4-6 gal.  3-4 lb.	Scales are usually controlled with the filbert-worm cover sprays. Use this treatment only when severe infestations exist. Do not tank mix diazinon with bordeaux or Kocide.
Eastern filbert blight	bordeaux 12-12-100 or Kocide 101	copper sulfate 48 lb. spray lime 48 lb. water 400 gal. 24 lb.	Spray prior to March 1.
<b>MARCH-APRIL</b>			
Big bud mite	Thiodan 50 WP	3 lb.	Complete coverage is necessary. Use no less than 25 gallons water per acre. Do not graze livestock in treated groves.
Bud moth (if a problem, usually the Thiodan treatment for bud mite will control this pest)	malathion 25 WP or parathion 25 WP	8 lb.  6 lb.	The larvae of the bud moth can cause serious damage to young trees by feeding on developing buds.
<b>APRIL-MAY</b>			
Filbert leafroller	diazinon 50 WP or Sevin 50 WP or Guthion 50 WP (azinphos-methyl) or Zolone 3 EC or Thiodan 50 WP	2-4 lb.  8 lb.  4 lb.  2-3 qt.  3-4 lb.	Apply as full coverage or concentrated sprays to insure complete coverage. Diazinon, Guthion, Thiodan, and Zolone will control bud moth and aphids too. Leafroller eggs begin hatching in late March and early April during warm weather.
Aphids (usually controlled with the leafroller spray)	diazinon 50 WP or Guthion 50 WP (azinphos-methyl) or Zolone 3 EC or Thiodan or malathion 25 WP or Metasystox-R	2-4 lb.  2-4 lb.  2-3 qt.  4-5 lb.  8 lb.  2 pt.	diazinon—0 days. Guthion—30 days. Do not graze for 21 days. Zolone—30 days. Thiodan—0 days. malathion—0 days. MSR as a foliar spray 116 days. Use as a full cover spray. Use only once per season
Omnivorous leaftier (if a problem)	Sevin 50 W or Guthion 50 W Pydrin 2.4 EC	6-8 lb.  3-4 lb. 5½-10¾ Fl oz.	Sevin—0 days. Guthion—30 days. Do not graze for 21 days. Pydrin - 21 days. Do not graze livestock in treated orchards.
<b>MAY-JUNE</b>			
To increase nut set	sodium penta-borate	4½-5 lb.	Do not apply if leaf boron was more than 150 ppm, use one-half rate if more than 100 ppm. Apply sodium pentaborate from mid to late May. Do not use in June.

**FILBERT SPRAY GUIDE—(Continued)**

Pest or disease	Material (see footnote 1, page 10)	Amt. of product/acre	Remarks; interval between last application and harvest
Obliquebanded leafroller	Sevin 50 W	6-8 lb.	Sevin—0 days.
	or diazinon 50 WP	4 lb.	diazinon—0 days.
	or Guthion 50 WP	2 lb.	Guthion—30 days. Do not graze for 21 days.
	Pydrin 2.4 EC	10 $\frac{2}{3}$ -21 $\frac{1}{3}$ Fl oz.	Pydrin - 21 days. Do not graze livestock in treated orchards.
Tent caterpillars	Sevin 50 WP	2-3 lb./100 gal.	Sevin—0 days.
	or diazinon 50 W	1-2 lb./100 gal.	diazinon—0 days. Spot treat localized infestations. This insect is easily controlled with spot treatments of most insecticides including diazinon, malathion, or Guthion.
<b>JULY-AUGUST</b>			
Scales (usually controlled with the filbertworm cover spray)	malathion 25 WP	6-8 lb.	malathion—0 days. Apply as full coverage spray when crawlers appear.
Filbertworm	Guthion 50 WP (azinphos-methyl)	4 lb.	Guthion—30 days. Do not graze for 21 days.
	or Sevin 50 WP	8 lb.	
	or Zolone 3 EC	2-3 qt.	Zolone—30 days. Apply insecticides 10-14 days after the filbertworm moths emerge. Repeat application may be necessary in 3 weeks or sooner particularly if heavy rains wash the first application off.
	Pydrin 2.4 EC	10 $\frac{2}{3}$ -21 $\frac{1}{3}$ Fl oz.	Pydrin - 21 days. Do not graze livestock in treated orchards.
Spider mites (if a problem)	Kelthane 35 WP	6-8 lb.	Kelthane—7 days.
<b>LATE AUGUST-SEPTEMBER</b>			
To hasten nut drop	ethephon	3.5 pt./100 gal.	When nuts first loose in husk—usually 4th week in August. Varying the concentration if chemical will alter the response obtained.
Bacterial blight	bordeaux 6-3-100 or	copper sulfate 24 lb. spray lime 12 lb. water 400 gal.	If heavy rains occur, repeat spray when three-fourth of the leaves have dropped.
	Kocide 101 or	16-24 lb.	
	dusts		For formulation and rates, see page 6 (top, left).
Obliquebanded leafroller (second generation larvae occur in late September and October. In certain orchards a fall spray after harvest has reduced damage from this insect the following year)	Sevin 50 WP	6-8 lb.	Sevin—0 days.
	or diazinon 50 WP	4 lb.	diazinon—0 days.
	or Guthion 50 WP	2 lb.	Guthion—30 days.
	Pydrin 2.4 EC	10 $\frac{2}{3}$ -21 $\frac{1}{3}$ Fl. oz.	Pydrin - 21 days. Do not graze livestock in treated orchards.
<b>NOVEMBER-DECEMBER</b>			
Eastern filbert blight	bordeaux 12-12-100 or	copper sulfate 48 lb. spray lime 48 lb. water 400 gal.	
	Kocide 101	24 lb.	

## FILBERT SPRAY RATES AND MINIMUM NUMBER OF DAYS BETWEEN LAST APPLICATION AND HARVEST

Pesticide	Material per acre <sup>1</sup>	Minimum number of days between last application and harvest
<b>Insecticides</b>		
<i>Bacillus thuringiensis</i> (Dipel, Thuricide, Bactur and others.)	see individual manufacturers' label	0
diazinon 50 WP	2-4 lb.	0
Guthion (azinphosmethyl) 50 WP	4 lb.	30
Kelthane 35 WP	6-8 lb.	7
malathion 25 WP	8 lb.	0
Metasystox-R SC	1 pt./10 trees	105—Use as a trunk paint only. Do not use as a cover spray.
parathion 25 WP	4 lb.	Do not use after husks open.
Sevin 50 WP	8 lb.	0
Systox 2	3-4 pt.	40
Thiodan 50 WP	3-5 lb.	0
Zolone	2-3 qt.	30
<b>Bactericides</b>		
bordeaux 6-3-100	copper sulfate 24 lb. spray lime 12 lb. water 400 gal.	Exempt
bordeaux 12-12-100	spray lime 48 lb. copper sulfate 48 lb. water 400 gal.	Exempt
Kocide 101	16-24 lb.	Exempt

<sup>1</sup> More than one type of formulation is available for most insecticides. For instance, diazinon is marketed as a 50% wettable powder (diazinon 50 WP) as well as an emulsifiable concentrate (diazinon AG 500). Lower rates can be used on smaller trees.

### EPA REENTRY RESTRICTIONS

Reentry refers to time limitations placed on field workers after pesticide application. It does not refer to preharvest intervals. The general standard states that workers shall not reenter fields treated with a pesticide (unless they are wearing protective clothing and equipment) until sprays have dried or dusts settled, unless exempted from such requirements, or a longer reentry time has been assigned to that pesticide.

Pesticides containing the following active ingredients have a reentry time of at least the interval indicated. State regulatory agencies may set and enforce more restrictive standards for workers. If pesticide labels bear restrictions more stringent than those set forth below, the label restrictions shall apply.

Pesticide	Minimum Reentry Period (hrs.)
ethyl parathion	48
methyl parathion	48
Guthion	24
demeton (Systox)	48
phosalone (Zolone)	24
Metasystox-R	48
Endrin	48

The preceding requirements notwithstanding, workers should not be permitted to enter treated fields if special circumstances exist which would reasonably lead one to conclude that such reentry would be unsafe.

The U.S. Department of Labor, Occupational Health and Safety Administration and the appropriate state enforcement agency may establish reentry rules or guidelines different than those listed above. Such variations will be publicized as they are developed.

## WALNUT SPRAY GUIDE

Pest or disease	Material (see footnote 1, page 12)	Amt. of product/acre	Remarks; interval between last application and harvest
<b>SPRING</b>			
<b>1. LATE MARCH TO EARLY APRIL (PREBLOOM STAGE)</b>			
Blight and blotch	bordeaux 4-2-100 plus summer oil emulsion	copper sulfate 16 lb. spray lime 8 lb. 400 gal. water plus 4 pt. emulsion	Amounts are based on the application of 400 gal. of water per acre. The low lime formula reduces the possibility of bordeaux foliage injury.
	or		
	Kocide 101 plus supreme or superior type oil	8 lb. 1 qt.	Amounts are based on the application of 400 gal. of water per acre.
	or		
	tribasic copper sulfate plus spreader-sticker	12 lb. 4-6 oz.	Amounts are based on the application of 400 gal. of water per acre. Follow manufacturer's directions.
	or		
	dusts		See page 7 (top right) for formulation and rate.
<b>2. EARLY TO MID-MAY (EARLY POST BLOOM STAGE)</b>			
Blight and blotch			Repeat above spray.
<b>3. LATE MAY (LATE POST BLOOM STAGE)</b>			
Blight and blotch			Repeat above spray.
<b>JUNE-JULY</b>			
Aphids	diazinon	2 lb.	diazinon—Do not use after husks open.
	or		
	Zolone 50 WP	4-6 lb.	Zolone—Do not apply after husks open.
	or		
	malathion 25 WP	4-6 lb.	malathion—0 days.
	or		
	Supracide 2E	4 qt.	Supracide—7 days.
Scales (Apply when crawlers appear)	diazinon 50 WP	4-6 lb.	diazinon—Do not use after husks open.
	or		
	Supracide 2E	4 qt.	Supracide—7 days. Chemical control of scales is not usually necessary.
<b>JULY-AUGUST</b>			
Walnut husk fly	malathion 25 WP	8 lb.	malathion—0 days.
	or		
	phosphamidon	1 pt.	phosphamidon—7 days.
	or		
	Zolone 3 EC	2-3 qt.	Zolone—30 days. Note: 2 to 3 applications may be necessary particularly if rain washes the first off.
Fall webworm			Insecticides such as diazinon, malathion, or <i>Bacillus thuringiensis</i> will control this pest. Only spot treatments are necessary. Completely drench the infested branch. Applications made when the larvae are small are most effective.
<b>LATE SEPTEMBER-EARLY OCTOBER</b>			
Increase walnut drop from one-shake harvest	ethephon	1 2/3 pt./100 gal.	As hulls begin to crack naturally. Do not apply to weak trees, trees suffering from drought or trees with blackline. Apply only to healthy, vigorous trees.

## WALNUT SPRAY RATES AND MINIMUM NUMBER OF DAYS BETWEEN LAST APPLICATION AND HARVEST

Pesticide	Amount of formulated material per acre <sup>1</sup>	Minimum number of days between last application and harvest
diazinon 50 WP	2-6 lb.	do not apply after husks split
Guthion 50 WP	3-4 lb.	do not apply after husks split
malathion 25 WP	4-6 lb.	0
parathion 25 WP	3-4 lb.	do not apply after husks split
Supracide 2 E	4 qt.	7 days
Systox 2	2 pt.	21 days.
Thiodan 50 WP	4 lb.	do not apply after husks split
Zolone 3 EC	2-3 qt.	do not apply after husks split
Bactericide/Fungicide bordeaux 4-2-100	Copper sulfate 16 lb. Spray lime 8 lb. Water 400 gal.	no time limitations
Kocide 101	8 lb.	
tribasic copper sulfate	12 lb.	no time limitations

<sup>1</sup> Usually more than one type of formulation is available for most insecticides. For instance, diazinon is marketed as a 50% wettable powder (diazinon 50 WP) as well as an emulsifiable concentrate (diazinon AG 500). Lower rates can be used on small trees.

### EPA REENTRY RESTRICTIONS

Reentry refers to time limitations placed on field workers after pesticide application. It does not refer to preharvest intervals. The general standard states that workers shall not reenter fields treated with a pesticide (unless they are wearing protective clothing and equipment) until sprays have dried or dusts settled, unless exempted from such requirements, or a longer reentry time has been assigned to that pesticide.

Pesticides containing the following active ingredients have a reentry time of at least the interval indicated. State regulatory agencies may set and enforce more restrictive standards for workers. If pesticide labels bear restrictions more stringent than those set forth below, the label restrictions shall apply.

Pesticide	Minimum Reentry Period (hrs.)
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methyl parathion	48
Guthion	24
demeton (Systox)	48
phosalone (Zolone)	24
Metasystox-R	48
Endrin	48

The preceding requirements notwithstanding, workers should not be permitted to enter treated fields if special circumstances exist which would reasonably lead one to conclude that such reentry would be unsafe.

The U.S. Department of Labor, Occupational Health and Safety Administration and the appropriate state enforcement agency may establish reentry rules or guidelines different than those listed above. Such variations will be publicized as they are developed.

## VEGETATION MANAGEMENT AND WEED CONTROL

Vegetation management and weed control in filbert and walnut orchards is essential if a productive orchard is to be maintained. Weedy plants often are controlled in strips beneath the tree rows and the remaining vegetation is mowed or cultivated during summer, when soil moisture becomes limiting, and before harvest. Most perennial, biennial, and annual weeds such as false dandelion, filaree, bull thistle, prostrate knotweed, and others should be controlled before they become established in the orchard. During winter, soil erosion can be reduced by allowing weeds such as annual blue grass to grow or by planting cover crops. Read Oregon Extension Circular 795, Soil Management in Non-Irrigated Orchards, for more information about soil and vegetation management in filbert and walnut orchards.

Herbicides can provide effective and economic weed control when used as an integral part of a year-round weed management program. Accurate application of selective herbicides or the use of special application equipment for less selective herbicides will inhibit or control weed growth with minimal chance for crop injury. Flailing complements the use of herbicides and controls vegetation mechanically throughout the growing season before harvest.

Accurate weed identification is essential to select the most effective herbicides throughout the life of the orchard. Continual use of the same herbicide or herbicide type will result in resistant weed species or plant biotypes. Each year, identify and map the location of common weeds. Consult labels and other publications listed at the end of this guide for information about control of specific weeds. Your weed control program may be improved or modified by rotating or selecting different types of herbicides and control methods. Spot treatment will eliminate seedy plants that become established as resistant weeds. Herbicide combinations applied separately at the correct time of year, or as tank-mixes, will control a broader spectrum of weeds.

Apply herbicides correctly. Proper application of herbicides will improve weed control and reduce the chance of crop or personal injury. Herbicides must be applied uniformly as described on the product label. Proper equipment, calibrated to deliver exactly the correct rate, and application at the proper time of year are essential. Obtain more consistent results by *reading and understanding each herbicide label* before application. Carefully note the precautions printed on the product label and the information listed in the following chart:

### SUGGESTED HERBICIDES FOR FILBERTS AND WALNUTS

Herbicide name	Amount per acre*		Time of application	Remarks
	Active ingredient	Formulated product		
<b>Site preparation</b> glyphosate (Roundup)	1-4 lb. ai./A.	1-4 qt./A.	Apply to actively growing annual weeds or perennials in correct stage of growth as listed on the label. Examples: quackgrass in three- to four-leaf stage; Canada thistle in bud stage; field bindweed in mid-flower stage, etc.	Repeat applications may be necessary. Do not apply more than 10.6 qt. in 1 year.
<b>New plantings</b> oryzalin (Surflan)	2-4 lb. ai./A.	2-4 qt./A.	Late fall to early spring to weed-free soil. Apply after soil is settled following tree planting.	Not recommended for use on soils containing more than 3% organic matter. Apply only once per growing season. Shallow cultivation may follow application.
trifluralin (Treflan)	0.5-1.0 lb. ai./A.	(Walnut only) 1-2 pt./A. depending on soil organic matter	Preplant and incorporate within 8 hours by cross-discing or rotary tilling.	If crops are to be planted between the trees, plant crops and follow directions listed on the label.
dichlobenil (Casoron, Norosac).	4-6 lb. ai./A.	100-150 lb. 4% granular/A.	Apply 4 weeks after tree planting before weed emergence or after Canada thistle rosettes are developed.	Irrigate if temperatures exceed 70° F. or if no rain occurs after application. Apply higher rates for perennial weeds. Do not graze livestock in treated areas.
norflurazon (Solicam)	2-4 lbs. ai./A.	2.5-5.0 lbs. 80% WP/A	Fall to spring before weeds emerge to soil free of excess plant debris or newly emerged weeds.	Direct treatment towards base of trunk. Avoid contact with fruit and foliage. Use in established orchards planted at least 18 months.
<b>Established plantings—winter applications that persist: Note—Rotate these herbicides to reduce resistant weeds from occurring in your orchard.</b>				
simazine	2-4 lb. ai./A.	2.5-5 lb. of 80% WP OR 2.2-4.4 lb. of 90% dispersible granules/A.	Single applications of 4 lb. in fall or spring before weed emergence and fall rains, but after nut harvest. Split application at lowest rate of 2 lb. ai./A. in fall and spring.	Do not apply on very light sandy soils or new orchards. Apply in strips or squares around trees if orchards are planted on steep hillsides to reduce erosion. Moisture is required for activation in the soil.
dichlobenil (Casoron, Norosac).	4-6 lb. ai./A.	100-150 lb. 4% granular/A.	After harvest in fall through spring rainy season before weed emergence or after Canada thistle rosettes are developed.	Irrigate if temperatures exceed 70° F., or if no rain occurs after application. Apply higher rates to perennial weeds. Do not graze livestock in treated areas.

## SUGGESTED HERBICIDES FOR FILBERTS AND WALNUTS (Continued)

Herbicide name	Amount per acre*		Time of application	Remarks
	Active ingredient	Formulated product		
norflurazon (Solicam)	2-4 lb. ai./A.	2.5-5 lb. of 80% WP/A.	In spring before weeds emerge to soil free of excess debris and existing vegetation.	Apply as a directed spray, avoiding contact with nuts and foliage. Soil moisture is required for herbicide activation. Apply only one time per year to established trees at least 1 year old.
napropamide (Devrinol)	4 lb. ai./A.	8 lb. of 50% WP/A.	Fall through early spring before weeds emerge to soil free of excess debris and existing vegetation. Labeled also as tank-mix with paraquat.	Incorporate (with rainfall or mechanically) in top 1 to 2 inches of soil to activate herbicide and reduce photo-decomposition (loss caused by sunlight).
oryzalin (Surflan)	2-4 lbs. ai./A.	2-4 qts. Surflan A.S./A. or 2 $\frac{1}{2}$ - 5 $\frac{1}{2}$ lbs. 75W/A.	Late fall to early spring to weed-free soil. Consult other labels for precautions when tank-mixing with simazine.	A single 0.5-inch rain or shallow cultivation is required for activation. Avoid overlaps, misapplications, or lack of adequate agitation to reduce chance of injury.
<b>Established plantings—applications to weed foliage during growing season</b>				
dinoseb	1.9 lb. ai./A.	3 pt. phenol OR 5.1 pt. amine formulation + 1 qt. weed oil/A.	When weeds are small. Use sufficient volume water to wet weed foliage.	Do not apply to trees less than 4 years old because uptake can occur through lenticels in young bark and cause injury to trees. Do not spray on foliage or dropped nuts, nor graze livestock in treated areas.
Paraquat Cl, Gramoxone	0.5-1 lb. ai./A.	1-2 qt./A. + non-ionic spreader in sufficient water to wet weed foliage	Anytime when weeds are succulent and new growth is 1 to 6 inches tall.	Apply as a directed spray towards base of trees. Use a shield for young trees and avoid contact with foliage, nuts, and young tree trunks. Do not graze treated areas. Can be tank-mixed with napropamide.
glyphosate (Roundup)	Spray 1-4 lb. ai./A.	1-4 qt./A.	Apply to actively growing annual weeds or perennials in correct stage of growth as listed on the label. Examples: quackgrass in three- to four-leaf stage; Canada thistle in bud stage; field bindweed in mid-flower stage, etc.	Repeat treatments may be necessary. Apply as a directed spray towards base of trunk on trees with mature brown bark. Do not spray green bark or foliage, nor exceed 10.6 qt./A. in 1 year.
	Selective wiper 33% solution	1 gal. product in 2 gals. water.	Apply to one or preferably two sides of weeds with selective wiper equipment when weed is in correct stage of growth.	Avoid contact with desirable vegetation. In severe infestations, reduce equipment ground speed or apply in two directions to ensure contact with the wiper.
Sucker control		(Filberts only)		
Paraquat Cl, Gramoxone	0.5-1 lb. ai./A.	2-4 qt./A. + non-ionic spreader in 50-100 gal. water.	Three to four times per season when suckers are 9 to 12 inches long, but before they become woody.	Direct the spray towards young suckers at the tree base. Avoid contact with foliage, fruit and young tree trunks. Do not graze treated areas.

\* Herbicides listed in this chart are formulated as liquids, wettable powders (WP), or dispersible granules. Application rates are listed in both actual or active ingredient (ai.) and formulation. Read the entire label to be certain that the correct formulation and rate are being used.

### ADDITIONAL WEED CONTROL INFORMATION

1. Growing Filberts in Oregon, Extension Bulletin 628.
2. Growing Walnuts in the Pacific Northwest, Extension Circular 974.

# COMPATIBILITY CHART

Bordeaux														
C	C	Fixed Copper												
Q	Q	Diazinon												
Q	Q	C	Guthion											
		C	C	Kelthane										
C	C	D	D	Lime										
D	D	C	C	C	Q	Malathion								
D	D	C	C	C	D	C	Parathion							
Q	C	C	C	C	C	C	C	C	Phosphamidon					
Q		C	C	C	Q	C	C	C	Pydrin					
	Q	C	C	C		C	C	C	C	Sevin				
C	C	C	C	C	C	C	C	C	Q	C	Elemental Sulfur			
	C	C	C	C	C	C	C	C	C	C	Superior oil, Supreme oil			
Q	D	Q	C	C	Q	C	C	C	C	Q	C	Supracide		
Q	Q	C	C	C	D	C	C	C	*C	C	C	C	C	Systox, Metasystox-R
	C	C	C	C		C	C	C	C	C	C	C	C	Thiodan
Q	Q	Q	Q	C	Q	Q	C	C	C	Q	C	C	C	Zolone

- C Materials Compatible
  - D Decomposes on standing; residual action reduced
  - Q Questionable; compatibility not clear
- Not compatible

Compatibilities may differ depending on formulation. Read the label and do the jar\*\* test before mixing. Most formulations of Bacillus Thuringiensis are generally compatible with most insecticides and fungicides if mixed in the tank just prior to application. Nutrient sprays should be applied separately unless compatibility is known.

\*\* Jar test = mixing a small portion of the pesticides together with water to see if problems appear, before addition to the spray tank.

\*C Mix only in equipment having excellent agitation; spray immediately upon mixing.









