

EB0845

COLLEGE OF AGRICULTURAL, HUMAN, AND NATURAL RESOUCES SCIENCES

2004

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CRANBERRY PEST  
MANAGEMENT  
GUIDE

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WASHINGTON STATE UNIVERSITY  
 EXTENSION

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Use pesticides with care. Apply them only to plants, animals, or sites listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

# 2004 Cranberry Pest Management Guide

NOTE: WSU recommendations are based on the latest available information. They may occasionally differ from a label. If so, the label instructions supercede WSU instructions. Always check the label before using the chemical. This guide replaces earlier editions. Do not use after December 31, 2004.

NEW DEVELOPMENTS: A Stinger label is predicted to be registered for cranberries sometime in 2003. Please contact your county extension specialist or WSDA to determine whether this label has been approved and is legal to use.

## Insect and Disease Control

The following information lists and describes chemical control measures suggested for the more common insect pests and diseases of cranberries. The recommendations are based on research by Washington State University, the USDA, and other agencies. The materials suggested are considered safe to use (when directions on the label are followed carefully) and are known to be effective.

In many cases, additional information may be desired on description of these pests, their damage, their life cycle, and their control. If your problem goes beyond the scope of this discussion, you can get additional help from your county extension agent or cranberry specialist (e.g., Kim Patten 360-642-2031; e-mail: pattenk@cahe.wsu.edu).

### PRECAUTIONS IN USING PESTICIDES

Before using any pesticide, you must have the product label in your possession. READ and FOLLOW all directions and precautions on the label. **Cranberries must be listed on the label of the material you use. Occasionally they will be on the label of one brand or formulation but not on another.**

If a product has recently had cranberries added to the label, you may need to obtain a supplemental label from the distributor.

Pesticides are poisonous to humans and animals. Use them only when needed and handle them with care.

Keep pesticides in their original containers. Store them in closed containers in a dry place. Avoid freezing temperatures. Store them where they will not contaminate food, feed, or water sources; and preferably in locked storage where children and animals cannot reach them.

If a liquid product freezes and separates, contact the manufacturer before using.

**Be certain that the pesticide label permits chemigation of cranberries before applying it through the sprinkler system.**

Be especially careful not to introduce pesticides into bodies of water during chemigating.

Avoid contact with pesticides. If any is spilled on skin or clothing, wash it off the skin thoroughly with soap and water and change clothing immediately.

Avoid inhaling pesticide dusts or mists.

When handling pesticides, wear clean, dry clothing.

Wear rubber gloves, approved for use with pesticides.

Wash your hands and face immediately after completing pesticide application.

Do not eat, chew gum, smoke, or use chewing tobacco while handling pesticides or before washing.

To protect fish and wildlife, do not contaminate lakes, streams, or ponds with pesticide. Do not clean spraying equipment or dump excess spray material near water.

Dispose of pesticide containers so they do not pose a threat to human beings or the environment. Rinse empty containers at least three times and pour the rinse water into the spray tank. Unless containers can be returned to the manufacturer or sold to a commercial salvage firm, puncture, crush, or break them (except for aerosol cans) so they **cannot** be used for other purposes. They can then be taken to a sanitary landfill dump or other site approved by the local health department. Landfills currently accepting such containers are located in Aberdeen 360-533-1251, and Long Beach 360-642-9382. Call to verify hours and conditions first. Burning empty pesticide containers is **PROHIBITED** by state air quality regulations; such burning can produce toxic fumes. Dispose of pesticides no longer registered for use on cranberries. The time to do this is now. Inventory pesticides you have which fall into this category. Transfer product to producers of other crops that are still on the label. (Your distributor may be able to assist in the transfer.) Return product to the manufacturer for disposal where possible. Order only the amount of pesticides that you will use during the year. Use older material first. Contact your Extension agent for Hazardous Waste Disposal Events and other options.

## HEALTH HAZARDS

All pesticides are poisonous; *some are toxic in very small amounts and may be absorbed through the skin or inhaled in quantities that endanger the health or even the life of the operator.* The degree of danger and the necessary precautions are indicated on pesticide container labels. *Read the manufacturer's label carefully and follow the instructions on it.* Also refer to Material Safety Data Sheets (MSDS) for more information. (See resources at the end of this publication for online sources of pesticide labels and MSDS.)

## WORKER PROTECTION STANDARD

The federal Worker Protection Standard (WPS) requires agricultural employers to protect their worker and handler employees from exposure to pesticides. This standard is comprehensive and complex. A "How to Comply" manual developed by EPA is available from a number of sources including county Extension offices.

## REENTRY TIMES

No one may enter a pesticide-treated field without wearing personal protective equipment specified on the label until the assigned reentry time has elapsed. **Check the pesticide label for reentry times.** Assigned times may range from 4 hours to several days. If the reentry time is longer than 24 hours, the field must be posted against reentry. Call the Washington Labor & Industry Office (360) 902-5426 for details on protective clothing and on posting rules as new requirements are pending.

## RESTRICTED USE PESTICIDES

Certain pesticides are designated "restricted use." Only certified applicators may purchase and apply them. Check with your Cooperative Extension agent for a list of cranberry pesticides that carry restricted use designation, and ask how you can become certified.

## APPLICATION OF PESTICIDES THROUGH A CHEMIGATION SYSTEM

Most growers rely upon chemigation for the application of their fungicides and insecticides. Several precautions must be observed for this use:

- The product must have a label allowing chemigation.
- The irrigation system should be well designed and have a uniform application rate across the entire field. Crop injury, lack of effectiveness or illegal pesticide residues in the crop can result from uneven distribution.
- Apply during calm periods to avoid drift and uneven application.
- Chemigation equipment must be calibrated to inject

the desired quantity of chemical. Be sure to agitate the chemical mixture in the supply tank at all times to avoid settling and uneven application.

- Apply the right amount of water to avoid runoff, drift or deep percolation. Pesticides must dry on the plant to be effective. The practical minimum application time is 1) the time required for the plant surface to become covered plus 2) the time required for the material to reach the extreme end of the system.
- Additional information on chemigation is available from WSU Cooperative Extension offices.

## RECORD KEEPING

Certified applicators and individuals applying pesticides to more than 1 acre of agricultural land in a calendar year are required to maintain records of their pesticide applications. The requirements for application records are found in RCW 17.21.100 of the Washington Pesticide Application Act and WAC 16-228-190 of the Rules Relating to General Pesticide Use. Applicators may keep their records in any format, as long as the required information is maintained, but may need to submit them on a WSDA prescribed form if requested to do so by that agency. WSDA offers five different record keeping forms, three of which are applicable to agricultural users. For forms contact WSDA at **360-902-2040** or [<http://arg.wa.gov/PestFert/FormsTopic.htm>]. Note: Be sure to 1) list formulation of product used, and 2) list both the first and last names of the applicator.

## USING SPREADER-STICKER

Most modern insecticides and fungicides contain a spreader-sticker. It is often inadvisable and sometimes even dangerous to add a spreader-sticker to such formulations. (Check the label.) For example, do not add wetting agents or spreader-stickers to Bravo or other products that have chlorothalonil as the active ingredient. Avoid using stickers with other pesticides and fertilizers applied during the period 2 weeks before to 4 weeks after the last Bravo application. If a spreader-sticker is recommended, after all other materials have been added to the spray tank, add the spreader-sticker according to directions on the spreader-sticker label, a little at a time. *Test the amount by dipping cranberry tips in spray mixture.* If enough spreader sticker has been added, the leaves will wet evenly and thoroughly on both sides. If not, the spray mixture will draw up in beads and droplets. However, too much will cause the spray to run off the leaves and reduce the effectiveness of the pesticides.

Several herbicides require the addition of crop oil to the tank mix to achieve efficiency. Cranberry leaves can

be damaged by crop oils applied at too high a rate or during hot days. Consult your Extension agent for recommendations.

### 8-8-100 BORDEAUX MIXTURE FORMULA

**Ingredients.** Use 8 pounds bluestone (copper sulfate) for each 100 gallons of water. Instant bluestone may be used directly from the container; crystalline bluestone must be dissolved in water first to form a stock solution. Use 8 pounds of freshly hydrated or slaked lime for each 100 gallons of water. Mix the lime with enough water to form a thin paste, strain through a 20-mesh screen to remove lumps.

**Mixing.** Fill spray tank about two-thirds full with water. Then pour the bluestone slowly into the spray tank while the agitator is running. After the bluestone has dissolved add the lime. Then add more water to fill the tank and finally add spreader-sticker. *Do not combine Bordeaux mixture or Kocide with an insecticide.*

### PHYTOPHTHORA ROOT ROT CONTROL

This fungal disease is usually most severe in low or poorly drained areas. The disease can be controlled by improving drainage and stimulating root growth. Improve drainage by digging new lateral ditches, maintaining existing ditches, or adding drain tile or pipe. Promote new root growth by sanding and fertilizing plants, especially those at the margins of the weak areas. Soil applications of the fungicide Ridomil Gold have been beneficial when combined with modified soil drainage. Before using Ridomil Gold, confirm that the Phytophthora fungus is present (check with the Extension Agent). Use the liquid formulation of Ridomil Gold for broadcast or chemigation treatment and the granular formulations for spot treatment. When spot treating apply Ridomil Gold 10 feet into healthy vines. Apply granules when foliage is dry so granules fall through the canopy. Irrigate following application to move Ridomil Gold into the root zone. Retard spread of the pathogen by harvesting infected beds last, and by using vines free of the pathogen when planting new beds or renovating sections of established beds.

### COTTONBALL\*

This disease has reappeared in several beds in the Long Beach area. The fungus that causes the disease blights new upright growth in the spring. Later flowers become infected leading to a fruit rot called Cottonball or hard rot. The fungus survives the winter as mummified berries. In early spring spore cups form on these berries and the spores released from the cups infect new upright growth resulting in "tip blight." A second

type of spore produced on the dead tips infects flowers. Fungicide protection is needed in early spring and again during bloom. Protection during bloom is the most critical.

### ROSE BLOOM CONTROL

Protect new upright and runner growth from spores produced on the surface of the pink fleshy growths (abnormal branches). Effective control will reduce disease incidence (the number of rose bloom growths) the following spring. Start fungicidal protection when the growths first begin to take on a whitish cast; this marks the onset of spore production. For 'Stevens' this will be in early May (rough neck stage); and for 'McFarlin' and other cultivars, about 1 to 2 weeks later. Repeat at 14-day intervals until the growths wither (shriveled/dry up), but do not make more than three applications. Chemicals applied earlier in the spring do not cause the fleshy growths to wither before spores are produced.

### UPRIGHT DIEBACK

Symptoms first appear in spring with a general yellowing of leaves. This is usually followed by an orangish brown coloration or bronzing. Eventually affected uprights turn brown and die. Infected uprights can be scattered among healthy uprights or in patches. Dying uprights often occur on the same runner as healthy uprights. Runner also can be attacked, but roots are not affected. Only one of two fungi associated with upright dieback occurs in Pacific Northwest beds. *Phomopsis vaccinii* also causes the fruit disease known as viscid rot. Recent research found that *P. vaccinii* is frequently recovered from symptomless stems of uprights and runners. Fungicides applied during the growing season reduced the frequency of recovery. At this time it is not known if other fungi are associated with dead uprights.

### RED LEAF SPOT

This disease is often found on vines having excessive growth. Controlling vigor will minimize its effect on the vines. Only young leaves are susceptible, and symptoms first appear in mid-June to early July. Red leaf spot alone is not very destructive. Damage occurs when the fungus grows from the leaf into the stem, causing shoot tips to die. The black spot fungus often overgrows red leaf spots and the two fungi in combination cause considerable damage. To minimize damage apply Dithane M-45 (or equivalent mancozeb product) every 14 days when symptoms are observed and vine overgrowth is excessive.

\*Important to control even when economic returns for cranberries are low.

# INSECT AND DISEASE CONTROL IN CRANBERRIES

Time of application	Insect or disease	Materials*	Amt. formulation Per acre**		Tolerance in ppm	†PHI	REI	Remarks
			Use	300 gal./acre				
Early dormant stage (Nov. 1 to March 1)	Black vine weevil	†Admire	16 oz.	0.05	0.05	30 days	12 hr	Apply with 600–900 gallons of water/acre and immediately incorporate with rain or irrigation.
Late dormant stage till buds break dormancy (March 1 to 15)	Upright dieback	Bordeaux mixture 8-8-100 Champ Formula 2	24 lbs. 2/3 gal.	Exempt Exempt	Exempt Exempt	None None	48 hr 24 hr	<b>Do not</b> use Bordeaux mixture in combination with any insecticide.
Bud break	Cottonball (tip blight stage)	Bordeaux mixture 8-8-100	24 lbs.	Exempt	Exempt	None	48 hr	See cottonball control text on page 5. Check with Extension agent to see if Section 18 exemption exists for a more effective fungicide.
Rough neck (approx. May 1)	Rose bloom	Bordeaux mixtures 8-8-100, or Kocide 2000	24 lbs. 6 lbs.	Exempt Exempt	Exempt Exempt	None listed None listed	48 hr 24 hr	See Rose Bloom Control text.
Late April to early May	Black vine weevil	Entomopathogenic nematodes		Exempt	Exempt			Apply in accordance with manufacturer's directions when soil temperatures exceed 53° F.
Late hook (about May 15 ± 5 days). Avoid application of toxic insecticides after first blossoms appear. Killing bee pollinators will reduce yields.	Phytophthora root rot	Ridomil Gold EC, or Ridomil Gold GR	1–1 3/4 pts. 20–35 lbs.	4 4	4 4	45 days 45 days	48 hr 48 hr	See phytophthora root rot control on page 5.
	Rose bloom, ***	Use any fungicide at proper rate listed for the late dormant stage						<b>Do not</b> use Bordeaux mixture in combination with any insecticide. Apply Confirm at early larval stage. Apply Diazinon as soon as worms are found in vines or tips. Lorsban may only be applied two times per year. Orthene: Apply no more than 1.0 lb of active ingredient per acre per crop cycle. <b>Do not</b> apply Orthene or Sevin XLR Plus during bloom. Only Guthion and diazinon are labeled for tipworm.
	Black headed fireworm, or Tipworm (Tipworm is not present on all farms; consult WSU or Ocean Spray for recommendations)	Confirm 2F, or Diazinon 4 lb./gal. EC, or Diazinon 50WP, or Guthion 50WP, or Lorsban 4 lbs./gal. EC, or †Orthene 75S, or Sevin XLR Plus Success	1.0 pt. 2-4 pts. 4 lbs. 2 lbs. 3 pts. 1.3 lbs. 4 pts. 4–10 fl. oz.	1.0 0.5 0.5 0.5 1 0.5 10 0.01	1.0 0.5 0.5 0.5 1 0.5 10 0.01	30 days 7 days 7 days 21 days 60 days 75 days 7 days 21 days	4 hr 24 hr 24 hr 7 days 24 hr 24 hr 12 hr 4 hr	
Bloom	Black headed fireworm	Confirm 2F, or sprayable mating disruption pheromone, or Pyrenone, or Bt products	1.0 pt See label for use See label for use Rate varies by product	Exempt Exempt Exempt Exempt	Exempt Exempt Exempt Exempt	30 days None listed None None	4 hr 0 hr 12 hr 4 hr	Pyrenone and <i>B.t.</i> products provide temporary suppression of early instar stages of second generation larvae.
	Fruitworm	Confirm 2F	1.0 pt	1.0	1.0	30 days	4 hr	Consult WSU first for exact timing of fruitworm spray.
	Black vine weevil	Cryolite	See label for use	7	7	30 days	12 hr	

(continued)

Time of application	Insect or disease	Materials*	Amt. formulation			REI	Remarks
			Per acre**	Tolerance in ppm	††PHI		
Bloom continued	Red leafspot	Dithane M-45, or Dithane DF Rainshield	3-6 lbs. 3-6 lbs.	7 7	30 days 30 days	24 hr 24 hr	
	Cottonball	Abound Flowable	6.2-15.4 fl. oz.	0.5	3 days	4 hr	Check with Extension agent to see if a Section 18 exists for an effective fungicide.
Late bloom (when 80% of blossoms have dropped). To protect bee pollinators <b>do not</b> apply insecticide during blossoming. Remove bees before spraying with insecticides.	Black headed fireworm, or Fruitworm (Fruitworm is rare, consult WSU for recommendations)	Use same insecticide control as in the late hook stage, <b>except do not apply Orthene if it was used at late hook stage.</b>					Use insecticides only when necessary. Apply as soon as second generation larvae are seen (about July 5 ± 5 days).
	Fruit rot,**** or Storage rot, or Twig blight***** (Lophodermium), or Red leaf spot	Abound Flowable Bravo Weather Stik, or Bravo Ultrex, or Echo 90DF, or Ferbam Granuflo, or Kocide LF, or Kocide LF, or Kocide 2000, or Dithane M-45, or Dithane DF Rainshield, or Dithane F-45	6.2-15.4 fl. oz. See label for use See label for use 3.3-5.75 lbs. 6 lbs. 8 lbs. 10.6 pts. 6 lbs. 3-6 lbs. 3-6 lbs. 2.4-4.8 qts.	0.5 5 5 5 7 Exempt Exempt Exempt 7 7 5	3 days 50 days 50 days 50 days 50 days None listed None listed None listed 30 days†††† 30 days†††† 30 days††††	4 hr Δ Δ 12 hr 24 hr 24 hr 24 hr 24 hr 24 hr 24 hr 24 hr	These fungicides help to reduce fruit rot plus protect vines from twig blight. Repeat at 10- to 14-day intervals. Do <i>not</i> apply Bravo products more than three times per season.  Ferbam: Do not apply within 28 days after midbloom (equivalent to 50 days PHI).  <b>Do not</b> combine Bravo or Echo with surfactants or Dipel.  <b>Do not</b> use Kocide in combination with any insecticide.
July 1-15	Fruit rot, Storage rot Twig blight (Lophodermium) Red leaf spot	Any fungicide and its rate listed for late bloom.					
(Approximately) July 1-7	Cranberry girdler	†Diazinon G-14  Entomopathogenic nematodes Best to apply nematodes no earlier than 14 days following peak moth flight. Follow manufacturer's recommendations for application rates, timing and irrigation requirements.	21 lbs.	0.5  Exempt	7 days	12 hr	Diazinon: For a single application 14 to 21 days after peak flight (mid-July). For severe infestations, apply at peak flight and 14 days later (mid- to late June and mid-July).

# INSECT AND DISEASE CONTROL IN CRANBERRIES (Continued)

Time of application	Insect or disease	Materials*	Amt. formulation Per acre** Use 300 gal./acre	Tolerance in ppm	††PHI	REI	Remarks
July 25 to August 10	Fruit rot, or Storage rot, or Twig blight (Lophodermium)	Any fungicide at proper rate listed for late bloom.					Insecticides may be combined with fungicides if insect control is necessary. It is <b>not</b> advisable to use more than one of each in the tank at any given time. Check the label of each product to be combined for special mixing instructions. Use diazinon if scale insects are a problem. Spray for fireworm only if third generation larvae are seen.
	Fireworm, or Fruitworm, or Lecanium scale	Use any insecticide, <b>except</b> †Orthene (unless you have only used it once during the current season) at proper rate listed for the late hook stage. Only one postbloom use of Orthene is allowed—up to 75 days before harvest. Use Lorsban only if it will be applied at least 60 days before harvest.					
	Phytophthora root rot	See Ridomil Gold under late April to early May.					
August 20 to 25	Fruit rot, or Storage rot, or Twig blight (Lophodermium)	Any fungicide at proper rate listed for late bloom <b>except</b> Bravo, and Ferbam Granuflo.					Helpful for control of storage rots and twig blight if severe.
Mid- to late September	Black vine weevil	Entomopathogenic nematodes	See label for use	Exempt			Apply in accordance with manufacturer's directions regarding irrigation requirements and when soil temperatures exceed 53° F. Make a single application in spring or fall when larvae are present.
October	Root weevils	See remarks on flood-water control for weevils under root weevil section.					
	Phytophthora root rot	See Ridomil Gold under late April to early May.					

\*Pesticides are listed in alphabetical order and not necessarily in order of effectiveness. Products having the same active ingredient may be available under other trade names.

\*\*Do not exceed the amount indicated on product label.

\*\*\*This pest is not on the label. However, this use is legal when label directions and precautions are followed.

\*\*\*\*Including hard rot stage of cottonball.

\*\*\*\*\*If twig blight is present, Bravo or Mancozeb are recommended over other products.

†A special local need registration has been granted for this use under Section 24(c), FIFRA.

††PHI stands for preharvest interval or the minimum number of days from last application to harvest.

Abbreviations: WP-wettable powder; EC-emulsifiable concentrate; G-granules; F-flowable; S-soluble powder; DG-dispersible granules; WG-water dispersible granules.

‡‡Certain processors are requesting that growers voluntarily maintain a 60-day preharvest interval for EBDC fungicides (for example, mancozeb and ferbam).

REI = reentry interval

∅Check with County Educator to see if alternative material is available under a Section 18 Emergency exemption.

∆See label: REI varies by product.

## TWIG BLIGHT CONTROL\*

The onset of infection and need for fungicidal protection are linked to spore development. When the disease was more common, an IPM scout would monitor development of spores and notify growers when to make the first application. Repeat at 14-day intervals for a total of three applications. Effective control will reduce disease incidence (the number of blighted uprights) the following spring. Protect newly planted beds when nearby established beds have diseased plants, as spores of the fungus are carried by wind currents. When new beds become infected, the reduction in vine growth delays production and promotes weed growth. For chemigated beds, additional hand spraying may be necessary to achieve control in areas where sprinkler coverage is poor. If the disease appears, contact your County Extension educator to have spore development monitored.

## FRESH FRUIT KEEPING QUALITY

Fungicide use is only a part of the program to assure good keeping quality. Control of weeds and vine overgrowth, careful handling of the fruit, and avoiding irrigation during mid-day and **excess nitrogen fertilizer** are also essential.

## ROOT WEEVIL AND GRUB CONTROL

### Strawberry Root\* and Black Vine Weevil Control.

Mature larvae may be suppressed during May or September using nematodes, provided soil temperatures are above 53°F. Follow the producer's instructions as to rates and methods. Root weevils usually are not a problem in water-harvested beds. If they do occur there, hold the flood water 4 to 7 days after harvest. Mid-winter flooding is generally less effective.

## BLACK HEADED FIREWORM CONTROL

Insecticides should target recently hatched larvae before they become enclosed in the developing bud. This can be done only by visual inspection or sweeping. For moderate infestations, target first generation larvae in mid-May. For severe infestations, two insecticide applications 10 to 14 days apart during the first generation hatch in May will improve control. Control of the second generation is essential to prevent damage to vines and the crop. Male confusion/mating disruption tactics can be used at isolated beds of moderate infestation by applying encapsulated pheromones immediately after first male moth catch. Two applications at 10- to 14-day intervals are re-

\*These pests are not on the label. However this use is legal when label directions and precautions are followed.

quired. Pheromone trap catches are also used to predict emergence of second generation larvae, but sweep samples should be taken to confirm larval abundance and the stage of development. Pyrenone, *B.t.*-based materials, and Confirm are not toxic to bees and can be applied during pollination. Early instar (<1/8" long) larvae should be targeted and at least two applications at 7-day intervals are required. Applications made against larvae that are 1/4" long result in poor control. *B.t.*-based compounds and Pyrenone are sensitive to ultra-violet sunlight and should be applied in mix with a sticker at dusk.

## CRANBERRY GIRDLER

Although several tactics and pesticides can be used against cranberry girdler, none are especially effective. Pheromone traps indicate adult emergence and predict larval development, but estimate abundance only roughly. Temporary flooding (24 to 48 hours) during late July to late August may suppress recently hatched larvae, but may need to be repeated several times. To prevent fruit scald, start flooding at night to be above the tips by midmorning. Entomopathogenic nematodes can be effective if applied during early to mid-August. Two applications at 14-day intervals may be required for heavy infestations. Severely infested patches should be sanded or renovated, but at least 1 to 2" of sand are needed to prevent damage. Diazinon G-14 should be considered a last resort, after failure of the previous practices. Spot treatments of both entomopathogenic nematodes and Diazinon G-14 in areas of high infestation may be more cost effective than whole field applications. Caution: Flooding at these times may increase the incidence of fruit rot and lower the keeping quality of fresh fruit. A 4- to 5-week flood after harvest also may help to suppress girdler.

## CRANBERRY FRUITWORM

Cranberry fruitworm, *Acrobasis vaccinii* (Riley), is becoming increasingly common. It is not as voracious as the fireworm and feeds only on the berries. Generally the worms are through feeding well ahead of harvest, but in late, cool seasons larvae may still be in the berries at harvest time. Larvae brought to the warehouse in the berries will continue to feed, often webbing berries together. See page 6 for management guidelines.

## FALL FRUITWORM

Fall fruitworm, *Lotisma trigonana*, is a new pest in cranberries harvested for the fresh market. A native pest on Salal, it has become problematic on cranberries. Larvae consume fruit before and after harvest. Larvae, pupae, and moths may be present in consumer packages of fresh fruit. Little is known about the life cycle and control of this pest. Consult an extension specialist for recommendations.

## FROST AND SCALD CONTROL

**Frost.** Sprinkle during every frost period after buds have started to swell. Overuse of sprinkler irrigation for frost protection too early in the season, prior to bud swell, can result in reduced control of weed with herbicides. During severe freezes, occasional sprinkling may not give complete protection. Coating with ice will help prevent desiccation. Do not turn off sprinklers until ice on the vines has melted.

**Scald.** Sprinkle during periods of high temperatures and low relative humidity. Turn sprinklers on before the temperature reaches 80° to 85°F. Beds with weak vines (e.g., herbicide, weevil, or disease damaged) are most susceptible to scald damage.

## Weed Control

Herbicide use in cranberry beds is often more difficult than in other crops and cropping situations. The root system of cranberries consists of a mass of fine, fibrous roots. Most of the roots are in the upper 4 to 6 inches of soil, making herbicide injury more likely. Furthermore, cranberry beds are acidic and usually high in organic matter; both soil characteristics affect herbicide action. If higher herbicide rates are used to gain weed control, chances for cranberry injury are increased. Under most conditions, the chemical weed control practices outlined have proved to be effective and selective to cranberries when carefully used according to directions. Soil pH management can be an important tool in controlling weeds. Soil pH's above 5.0 will encourage some species of weeds. Gradually lowering pH with elemental sulfur when combined with a good herbicide program is an effective means to control some leguminous weeds. Avoid use of any elemental sulfur in areas that are poorly drained.

### SWAB TREATMENTS

#### Tall weeds on beds

- Glyphosate (Roundup)—Use solutions as directed by product label, swabbed on weeds extending at least 6 inches above cranberry vines.

Do not allow solution to drip or touch cranberry vines. Apply no later than 30 days before harvest. Repeat treatment may be necessary; wipe in both directions to improve results; use a recommended dye to observe coverage patterns. Do not use, mix, or store in galvanized pipe or container. Rainfall or irrigation occurring within 6 hours after application may reduce effectiveness. Poor growing conditions such as stress,

disease or insect damage also may reduce effectiveness. Adding 2,4-D to Roundup may improve control against some broadleaf weeds. Do not mix these two products together without diluting one first, or they may solidify.

Roundup (50% to 100% solution) also may be applied as a stump treatment or injection and frill application. Use for woody brush control in and around cranberry beds. Apply after fruit set and no later than 30 days before harvest.

- 2,4-D amine—10% to 33% solution swabbed on weeds extending above cranberry vines.

The only 2,4-D amine formulation registered for this use is sold under the trade name Weedar 64. Special local need registration is No. WA010025. The label must be in the grower's possession at the time of application.

Do not allow the solution to drip or touch cranberry vines. Apply only once per year. 2,4-D is volatile. Application during hot weather will injure vines and flowers.

- Sulfosate (Touchdown)—25% solution for wick wipers. Add nonionic surfactant at 0.25% V/V. Touchdown can only be used on nonbearing vines. Apply to target weeds, avoiding contact with vines.
- Clopyralid (Stinger)—use a 2% solution as directed by product label on susceptible weed species that extend well above the cranberry canopy. The only Stinger formulation registered for this use is a special local needs label (WA030006). The label must be in the grower's possession at the time of application.

### POSTHARVEST SPOT TREATMENT OF WEEDS

- Glyphosate (Roundup Ultra)—apply after harvest on a spot treatment basis using hand held sprayer to broadleaf and grass weed species. Do not treat more than 10% of the total bed and allow a minimum of 6 months PHI. Applications made at too high a rate, to vines not fully dormant or after dormancy has broken will result in crop damage. Best effects are obtained when applications are made to actively growing weeds. To avoid or minimize crop damage do not exceed 1 qt/A or 0.25% concentration sprayed to wet.

### NEW PLANTING PREPARATION

Preplant weed eradication of perennial weeds prior to planting is critical. Fumigation or multiple spraying

of new and established weeds with Roundup in the summer prior to planting a new bed or renovating a weedy bed is highly recommended. If sand is used on new plantings make sure it is free of weed seeds. Sand 3 to 4 inches deep is needed to prevent weeds from emerging through the layer. To avoid introducing new weed seeds, use vines that are taken from beds free of weeds.

### Pre-emergent Weed Control

- Norflurazon (Evital) at 1-2.5 lb active ingredient per A (20-50 lb product). Use lower rates (15-20 lb. product) on 'Stevens,' 'Crowley,' or 'Pilgrim' varieties on sandy soils. Injury may occur in areas where water puddles. Plants that are not true grasses resist treatment. For fescues and annual bluegrass control use clethodim (Select). Some growers have reported slight phytotoxicity from the crop oil concentrate used with grass herbicides. Damage is avoidable if products are not applied to runoff.
- Napropamide (Devrinol 10G) at 3 lb active ingredient per A (30 lb product). Use split applications of lower rates on sandy soils. Combinations of both Devrinol and Evital at low rates may improve weed control on new plantings. (Devrinol 50DF is no longer available, but existing stocks can be used.)

### Post-emergent Grass Control

- Sethoxydim (Poast) at 0.5-1.5% solution (4 tsp-4 tbsp + 8 tsp crop oil/gal water).
- Clethodim (Select 2EC) at 0.25% to 0.5% solution (2-4 tsp + 4 tsp crop oil/gal water).

Apply to actively growing grasses listed on label at the 4- to 5-leaf stage (6 to 12 inches tall).

Apply to obtain thorough coverage but not to runoff. Repeat treatment if necessary as often as three times (June, July, and August).

Erratic results occur when grasses are stressed from lack of vigor, drought, high temperature, low fertility, mature grass stage of growth, and unknown environmental factors.

New cranberry growth is sensitive to crop oil applied at high rates (>1%) with high spray volumes on hot days.

### GRASS CONTROL ON BEARING BEDS

- Sethoxydim (Poast) at 0.5% to 1.5% solution (4 tsp to 4 tbsp and 8 tsp crop oil/gal water). Use the higher

rates for perennial grass control. Repeated applications may also be necessary. Do not exceed 5 pints per acre per season. Do not apply within 60 days of harvest.

- Clethodim (Select 2EC)—see above for rate. Do not apply within 30 days of harvest.

### PERENNIAL BROADLEAF CONTROL ON BEARING BEDS

Perennial weeds such as silverleaf, purple aster, and lotus are difficult to control without damaging vines. Eradicate at the first stage of infestation. For severely infested plantings, consider split applications of Casoron. Make the first application (50 lb product) when the shoots first emerge in the spring (early March) and one month later. Mixing 10 lbs of 2,4-D G with each 50 lbs of Casoron application may improve control of some broadleaf species. Supplemental Devrinol at 70 to 120 lb product applied between mid-March and mid-April also may improve control of some perennials. For lotus and buttercup control, spot treatment in early February with high rates of Devrinol will provide suppression if followed by Casoron in early April. Weed control on poorly drained beds is likely to be erratic.

### Acute toxicity of pesticides

Product	Fish	Bees	Birds	Humans
<i>Fungicides</i>				
*Abound	2			
Bordeaux mixture	2			
Bravo	1			
Carbamate (ferbam)	2			
Kocide	2			
Mancozeb	2			
<i>Insecticides</i>				
Lorsban 4E	1	1		2
Diazinon 50W	2	1		2
Diazinon AG500/4EC	2	1		2
Diazinon G-14	2		1	2
Sevin (most formulations)		1		
Guthion (all formulations)	1	1		1
Pyrenone	2			
Orthene		1		
<i>Herbicides</i>				
Poast	2			
Weedar 64				2
1 = Extremely toxic    2 = Moderately toxic				
*The active ingredient in Abound is extremely toxic to McIntosh and McIntosh-related apple varieties. Do not apply near these tree varieties. Do not allow the release of irrigation or flood water into non-target aquatic habitats for at least 14 days after last application.				

# WEED CONTROL IN CRANBERRIES

Time of application	Weed*	Materials**	Amt. formulation per acre	Tolerance in ppm	Remarks
Dormant stage November–December	Cats-ear* or false dandelion, spikerush*, oniongrass*, cottontop*, rush*, broadleaf weeds	2,4-D 19.2% ae G	20 lbs.	0.5	Apply 2,4-D soon after weed emergence, while cranberries are completely dormant and dry. Use granular formulation. Do not use products with significant amounts of fine powder. Use only 2,4-D products registered for cranberries. 2,4-D provides only limited residual weed control.
February–late April	Birdsfoot trefoil (lotus*), buttercup*	Devrinol, 10% G †Devrinol 50DF (napropamide) Devrinol 50DF is no longer registered, but existing stocks can be used.	75–150 lbs. 8–18 lbs.	0.1 0.1	Apply Devrinol before start of spring growth to dry vines. Rain or sprinkler irrigation of at least 1/4 inch after application is essential for weed control. A split application (75 lbs. late Feb. and 50 lbs. mid-April) will provide better lotus and general overall weed control than a single application in February–March. Better control is achieved in beds where soil pH is less than 5.0. Do not exceed 150 lbs/A of Devrinol per year. Use lower rate on sand beds. Devrinol may lose effectiveness if repeatedly used at high rates in the same field for several years. For control of severe buttercup, use a single large application of Devrinol (100–150 lbs.) in January, combined with a split Casoron application in early March and April.
	Rice cutgrass, povertygrass*, smokegrass, barnyard grass, needlegrass, spikerush, nutsedge	Evital, 5% G (norflurazon)	50–160 lbs.	0.1	Do not apply after bud opening or more than once per year. Use lower rates on 'Stevens,' 'Crowley,' or 'Pilgrim' varieties, on sandy beds, or on beds having weak vines.

(continued)

Time of application	Weed*	Materials**	Amt. formulation per acre	Tolerance in ppm	Remarks
February-late April (continued)	Annual broadleaf weeds, purple aster, loosestrife, rush, sedge, grass, field horsetail, silverleaf.*	Casoron 4% G (dichlobenil)	40-100 lbs.	0.1	Better weed control can be achieved by using two equal applications in the spring (50 lbs. each). Make second application 3 to 6 weeks after first. Do not apply at or after popcorn stage. Do not exceed 100 lbs. of product per year on producing beds. Higher rates will reduce yields. Avoid overapplication, which may result from overlapping during treatment period.
	Multiple species—severe infestation	Casoron 4% G (dichlobenil) plus 2,4-D 19.2% ae G	30-50 lbs. 5-15 lbs.	0.1 0.5	Better control of hard-to-kill weeds may be obtained by using these two herbicides in combination. Use granular formulations of these herbicides and follow all precautions and restrictions as given for each herbicide when used alone (see above). Do not apply at or beyond popcorn stage. May be used as a split application in late February and early to mid-April for more effective weed control.
November-late April and July-August	Birdsfoot trefoil (Lotus), purple Aster, clovers	†Stinger (clopyralid)	0.6 pt.	4.0	Application should be made post-emergent when weeds are clearly visible, but before they become too large. Timing will vary by species. SLN (WA 030006).

\*Weeds not on product label: some suggested uses of pesticides in this publication are for weeds not listed on the label. These are indicated by the symbol\*. Such uses comply with the federal law (FIFRA) which says a use is consistent with label instructions provided the crop or site is on the label and directions concerning rates and interval before harvest are followed.

\*\*Do not exceed the amount indicated on product label. ae means acid equivalent.

†A special local need registration has been granted for this use under Section 24 (c), FIFRA.

# SPRAY COMPATIBILITY (ABILITY TO MIX) CHART FOR FUNGICIDES AND INSECTICIDES

## Combining Chemicals

It may be to your advantage to control several problems with a single spray application by combining several chemicals. Read the label and follow the manufacturer's directions when making these mixtures. This compatibility chart is provided to help you in preliminary planning only. Compatibilities can vary from those indicated on this chart because of change in solvents and emulsifying agents, etc. It is a good idea before making a tank mixture to perform a "jar test." Mix the chemicals in a jar of water at approximately the recommended dilution rate. After thorough shaking, let stand for 20 minutes. If the combination remains mixed, or can be remixed readily, the mixture is physically compatible. Some mixtures may be phytotoxic (cause plant injury). To determine if a combination is phytotoxic spray a small area and then evaluate 3 to 7 days later for visual effects. Agitation is recommended when mixing and using mixtures of pesticides.

When preparing mixtures, add wettable powder or water-dispersible granules to the tank first, followed by flowable products. Add emulsifiable concentrate products last. Again, be sure to provide adequate agitation in the tank while mixing.

	Sevin	Orthene	Mancozeb	malathion	Lorsban	Kocide	Guthion	ferbam	diazinon	Bravo*	Bordeaux	Ridomil Gold	Abound**
Bordeaux	2	2	C	2	X		2	C	2			?	?
*Bravo					C		1						?
diazinon		C				2					2	?	?
ferbam					?	C					C	?	?
Guthion		X				2				1	2	?	?
Kocide	2	2	C	2	X		2	C	2			?	?
Lorsban			C			X		?		C	X		?
malathion						2					2	?	?
mancozeb					C	C					C		?
Orthene						2	X		C		2	?	?
Sevin						2					2	?	?
Ridomil Gold	?	?		?		?	?	?	?		?		?
**Abound	?	?	?	?	?	?	?	?	?	?	?	?	

Blank = Normally compatible; however, most recent compatibility charts suggest not to mix unless approved by manufacturer.

C = Caution, may be incompatible or compatibility unknown.

X = Incompatible

1 = Use wettable or soluble powder forms

2 = Do not combine Bordeaux mixture or Kocide with an insecticide

? = Compatibility profile unknown

\* Do not use a spreader-sticker with Bravo

\*\*Abound flowable is compatible with many commonly used pesticides, liquid fertilizers, and biological control products. Nonetheless performing a "jar test" is still recommended.

## RESOURCES

### Hard copy:

*Calibrating and Using a Backpack Sprayer*, PNW0320.  
Caruso, F.L. and D.C. Ramsdell. 1995. *Compendium of Blueberry and Cranberry Diseases*. 87 pages. APS Press, 3340 Pilot Knob Road, St. Paul, MN 55121-2097, 1-800-328-7560 <http://www.APSnet.org>

*Concepts of Integrated Pest Management in Washington*, EB0753.

*Cranberry Production in the Pacific Northwest*. PNW 247. 50pp.

*How to Reduce Bee Poisoning from Pesticides*, PNW518.

*Laundering Pesticide Contaminated Clothing*, NE/HEG 18115.

*Pacific Northwest Insect Management Handbook*. Revised annually. Available through Washington State University Extension, Pullman; or Oregon State University Extension Service, Corvallis.

*Pacific Northwest Plant Disease Management Handbook*. Revised annually. Available through Washington State University Extension, Pullman; or Oregon State University Extension Service, Corvallis.

*Pacific Northwest Weed Management Handbook*. Revised annually. Available through Washington State University Extension, Pullman; or Oregon State University Extension Service, Corvallis.

### On-line:

WSU Pesticide Education Program Home Page  
<http://pep.wsu.edu>

Other useful world wide web sites:

WSU-Pest Management Resource Service  
<<http://wsprs.wsu.edu>>

Pesticide labels and MSDS Sheets  
<<http://www.greenbook.net/>>  
<<http://www.cdms.net/>>

WSU Cooperative Extension publications  
<<http://pubs.wsu.edu>>

National Ag. Safety Database Center for Disease Control  
<<http://www.cdc.gov/niosh/nasd/>>

Online Pest Management Handbooks  
Diseases <<http://plant-diseases.ippc.orst.edu/index.cfm>>  
Insects <<http://insects.ippc.orst.edu/pnw/insects>>  
Weeds <<http://weeds.ippc.orst.edu/pnw/weeds>>



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EB0845