

CHEMICAL CONTROL OF DISEASES AND INSECTS

BEARING APPLE ORCHARDS

The following calendar recommendations are intended only as a general guide. For more effective pest management, choice of pesticides, timing of sprays and rates should be based on systematic orchard scouting. Dilute spray is based on 400 gal per acre for a mature orchard on standard rootstock.

Spray combinations suggested are considered the best available for most situations. They are intended to be used in orchards bearing fruit that will be processed or sold fresh. These suggestions do not imply that other materials are not useful or satisfactory under some conditions. Past experience and knowledge of specific orchard situations should be relied upon in the selection and development of a spray program. New registrations or cancellations of pesticides may occur during the season. Follow extension announcements in Fruit Notes, Virginia Fruit Web Site (<http://www.ento.vt.edu/Fruitfiles/VAFS.html>), newspaper columns, newsletters, and radio programs. Where pH levels are indicated on pesticide label, determine pH of the finished mixture in the tank; adjust accordingly.

DORMANT SPRAYS

Effectiveness rating: **E = excellent, G = good, F = fair**

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Fireblight	G	C-O-C-S 50WDG	2-4 lb	—
		Kocide DF	2-4 lb	—
		Cuprofix Ultra 40	—	5.0-7.55 lb
		Bordeaux mixture (copper sulfate + agricultural spray lime) 325 Mesh ²	8 lb + 8 lb	—
		Various copper formulations	See label	See label

¹ Suggested where fireblight was difficult to control in the previous year or on young blocks of susceptible cultivars such as York Imperial, Fuji, Jonathan, Rome Beauty, Idared, Gala, and crabapple pollinizers and orchards planted on M.9, M.26 and Mark rootstock. Other coppers may also be suitable and may be easier to handle than Bordeaux mixture. **DO NOT APPLY COPPER AFTER FOLIAGE APPEARS BECAUSE OF POTENTIAL FOR RUSSETING.** Where there is less economic risk due to russetting as in fruit grown for processing, copper sprays applied from silver tip to half-inch green will protect against an early scab infection period.

² Particles larger than those produced by 325 mesh will clog and damage sprayer pump. See p. 25 for mixing instructions.

SILVER TIP - GREEN TIP SPRAY

4-5 oz	Effectiveness	Chemicals	100 gal Dilute	Acre Concentrate
San Jose Scale (SJS)	E = 1, 2, 3, 4, 5	1. ² Superior oil	2 gal	6 gal
Rosy apple aphid (RAA) ¹	E= 2, 3, 4, 5 G = 1	2. Lorsban 3.8E, Nufos 4E, Yuma 4E, or Lorsban 75WG	1 pt or 10 oz	2.5 pt or 2 lb
Green aphid (SA/AA) ¹	E= 2, 3, 4 G = 1, 5	3. Supracide 25WP	1-2 lb	3-6 lb
Mite eggs (ERM)	E=1	4. Supracide 2E	1-2 pt	3-6 pt
		5. Esteem 35W	-	4-5 oz

¹ Aphids are best controlled with the silver-tip or 1/4-1/2" green spray, otherwise they will be within curled leaves and protected from insecticides. "Green aphids" are a complex of two species, spirea aphid (SA) and apple aphid (AA). SA has recently been found to predominate over AA in our area; they are indistinguishable in the field. SA and AA are equivalent in damage potential. AA is more susceptible to Guthion and Asana than SA.

² Do not apply oil when the temperature is higher than 85°F or lower than 35°F. Use only oil having specifications that meet the standards for a superior oil. Always test such oil for physical compatibility before using it. See page 38 for details. Dilute applications of oil are more effective.

1/4 – 1/2 INCH GREEN SPRAY

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab	E = 1, 3, 4, 5, 6, 7, 8, 9,10, 11, 12, 14, 15, 16, 17, 19, 20, 30, 31, 32, 33 G = 2, 13, 18, 29	1. ¹ Dodine 65W	8 oz	1.5 lb
		2. ¹ Captan 50W	1.5 lb	6.0 lb
		3. Rubigan 1E + Captan 50W	3 fl oz + 1 lb	9 fl oz + 3.25 lb
		4. Rubigan 1E + ¹ Dodine 65W	3 fl oz + 4 oz	8-9 fl oz + 1 lb
		5. Rubigan 1E + Ziram 76DF	3 fl oz + 1 lb	9 fl oz + 3.25 lb
		6. Rubigan 1E + ³ mancozeb 75DF	3 fl oz + 1 lb	9 fl oz + 3 lb
		7. Rubigan 1E + ³ Polyram 80DF	3 fl oz + 1 lb	9 fl oz + 3 lb
		8. ² Rally 40WSP + ¹ Captan 50W	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3.25 lb
		9. ² Rally 40WSP + ¹ Dodine 65W	1.25-2.0 oz + 4 oz	5.0-7.5 oz + 1 lb
		10. ² Rally 40WSP + Ziram 76DF or WDG	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3.25 lb
		11. ² Rally 40WSP + ³ mancozeb 75DF	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3 lb
		12. ² Rally 40WSP + ³ Polyram 80DF	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3 lb
		13. Ziram 76DF or WDG	2 lb	6.5 lb
		14. Procure 50WS + Captan 50W	3 oz + 1 lb	12 oz + 3.25 lb
		15. Procure 50WS + mancozeb 75DF	3 oz + 1 lb	12 oz + 3 lb
		16. Procure 50WS + Polyram 80DF	3 oz + 1 lb	12 oz + 3 lb
		17. Procure 50WS + Ziram 76DF or WDG	3 oz + 1 lb	12 oz + 3 lb
		18. Vangard 75WG + mancozeb 75DF	- -	3 oz + 3.2 lb
		19. ⁴ Sovran 50WG	1.0-1.6 oz	4.0-6.4 oz
		20. ⁴ Flint 50WG	-	2.0-2.5 oz
		29. Scala 5SC + mancozeb 75DF	- -	5 fl oz 3.2 lb
		30. Indar 2F + Captan 50W	-	8 fl oz + 3.25 lb
		31. Indar 2F + Mancozeb 75DF	-	8 fl oz + 3 lb
		32. Indar 2F + Polyram 80DF	-	8 fl oz + 3 lb
		33. Indar 2F + Ziram 76 WDG	-	8 fl oz + 3 lb

¹ CAUTION: Do not use Captan or combinations involving Captan, with oil or within 4 days of an oil application. Check for tank-mix compatibility of dodine with oil. Some sporadic resistance of scab to dodine has occurred where used heavily for several years.

² See Rally label for rate per acre adjustment based on tree height. Rubigan, Rally, and Procure at the high rate, can be applied up to 4 days after the beginning of a scab infection period where an after-infection strategy is followed. When used in an after-infection strategy a follow-up application should be made a week later to kill the fungus in the lesion.

³ CAUTION: The EBDC fungicides (mancozeb and Polyram) are registered for limited usage on apples for control of scab, rusts and some summer diseases. The grower is given the option of using one of two schedules:

A. Apply 6.0 lb of the 75DF or 80DF formulations per acre per application from green tip stage through bloom, maximum 24 lb per acre per year.
or

B. Apply 3.0 lb per acre from green tip stage through second cover or up to 77 days to harvest, maximum 21 lb per acre per year.

The above schedules are not to be combined, so you must decide before the first spray which schedule best fits your needs. Because EBDCs have been most beneficial for summer disease control (especially bitter rot) and in applications which require a broad spectrum fungicide which is compatible with oil, the second option (3 lb per acre up to 77 days to harvest) is listed here as the preferred usage pattern. When used in the early cover sprays (or up to 77 days to harvest) EBDCs may have benefits for residual early summer disease control and compatibility in programs where oil is used with Sevin as a thinner. The 3.0 lb per acre EBDC rate cannot be relied on by itself for early season or summer disease control. Combinations with sterol-inhibiting fungicides (Rubigan, Rally, and Procure) have been well tested and are recommended for early season disease control (apple scab, rusts, powdery mildew); the benzimidazoles (Topsin and Topsin-M) are compatible with EBDCs and provide supplemental control for Brooks spot, sooty blotch, fly speck, black rot and white rot, but not for bitter rot. Captan and ziram are protectant fungicides that provide supplemental summer disease control. Incompatibilities among combinations of Captan, ziram, mancozeb or Polyram are not anticipated but are not well tested. Captan is incompatible with oil. See the additional note about EBDCs under the second cover spray, p. 63.

⁴ CAUTION; Sovran and Flint are recently registered strobilurin fungicides that will require a selected use strategy because of concern about development of resistance. Both fungicides have benefits for early season and summer disease management; however, they should not be used in more than two consecutive sprays. They should be alternated with two or three applications of non-strobilurin fungicides from other chemical classes for control of all diseases concerned. These fungicides may not provide curative activity under heavy rust pressure. Areas with heavy rust pressure will need to rely on sterol-inhibiting fungicides during periods of peak rust activity.

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1/4 – 1/2 INCH GREEN SPRAY1 (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
San Jose Scale (SJS)	E = 1, 2, 3, 4	1. Superior Oil	2 gal	6 gal
Rosy apple aphid	E = 19 (RAA) ² G = 2, 3, 4, 9, 10, 11, 14, 15, 16, 17, 18	2. ⁹ Lorsban 3.8, Nufos 4E, Yuma 4E or Lorsban 75WG	1 pt or 10 oz	2.5 pt or 2 lb
Green aphid (SA/AA)	E = 19 G = 2, 3, 4, 9, 10, 11, 14, 16, 17, 18	3. Supracide 25WP 4. Supracide 2E 5. Lannate 90SP	1-2 lb 1-2 pt 4 oz	3-6 lb 3-6 pt 12 oz
Mite eggs (ERM) ³	E = 1, 12, 13	6. Guthion 50W	8 oz	1.5 lb
Redbanded leafroller	G = 5 eggs (RBLR) ⁴	7. Imidan 70WSB 8. <i>Bacillus thuringiensis</i>	12-16 oz See label	2-3 lb See label
Defoliating caterpillars ⁵	E = 9, 10, 11, 14, 16, 17, 18 G = 2, 3, 4, 5, 6, 7, 8	9. ⁶ Perm-UP 3.2EC or Pounce 3.2EC 10. ⁶ Ambush 25WP or Perm-UP 25WP 11. ⁶ Asana XL or Adjourn 0.66EC 12. ⁷ Apollo 42SC 13. ⁸ Savey 50DF or Onager 1EC 14. ⁶ Danitol 2.4EC 15. Aza-Direct 16. ⁶ Warrior 1CS, Lambda-Cy 1EC, Silencer 1EC, or Warrior 2CS 17. ⁶ Proaxis 0.5CS 18. ⁶ Mustang Max 0.8EC 19. Beleaf 50SG	- - 2.0-5.8 fl oz - See label - - - - - -	4-16 fl oz 6.4-25.6 oz 4.8-14.5 fl oz 4-8 fl oz 3-6 oz or 12-24 fl oz 11-21 fl oz 1 qt 2.6-5.1 fl oz or 1.3-2.5 fl oz 2.6-5.1 fl oz 1.3-4 fl oz 2-2.8 oz

¹ See notes (silver tip - green tip spray).

² RAA is the most important aphid to control at this time. SA can be controlled effectively later in the season (by natural enemies and/or sprays). But action taken now for RAA will also control SA.

³ Where ERM eggs are abundant, *Stethorus punctum* adults will begin to move into trees. Begin regular monitoring of *Stethorus punctum* at this time.

⁴ RBLR eggs are killed only if in direct contact with Lannate spray.

⁵ Defoliating caterpillars include tent caterpillars, cankerworms, and cutworms.

⁶ Pyrethroid should be applied at most once per season, preferably at 1/2 inch green but no later than tight cluster-preparepink.

⁷ May be applied once per season, until 45 days before harvest; petal fall application is preferred.

⁸ May be applied once per season, until 28 days before harvest; petal fall application is preferred. Do not apply in less than 50 gal/A.

⁹ See notes on chlorpyrifos, p. 34

TIGHT CLUSTER - PREPINK SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab	E = 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 19, 20, 21, 30, 31, 32, 33 G = 2, 13, 18, 29 F = 22	1. Dodine 65W	8 oz	1.5 lb
		2. Captan 50W	1.5 lb	6.0 lb
		3. Rubigan 1E + Captan 50W	3 fl oz + 1 lb	9 fl oz + 3.25 lb
Powdery Mildew ²	E = 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 19, 20, 21 G = 14, 15, 16, 17, 22, 30, 31, 32, 33	4. Rubigan 1E + Dodine 65W	3 fl oz + 4 oz	8-9 fl oz + 1 lb
		5. Rubigan 1E + Ziram 76DF or WDG	3 fl oz + 1 lb	9 fl oz + 3.25 lb
		6. Rubigan 1E + mancozeb 75DF	3 fl oz + 1 lb	9 fl oz + 3 lb
Rusts	E = 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, 21, 30, 31, 32, 33 G = 3, 4, 13, 14	7. Rubigan 1E + Polyram 80DF	3 fl oz + 1 lb	9 fl oz + 3 lb
		8. Rally 40WSP + Captan 50W	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3.25 lb
		9. Rally 40WSP + Dodine 65W	1.25-2.0 oz + 4 oz	5.0-7.5 oz + 1 lb
		10. Rally 40WSP + Ziram 76DF or WDG	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3.25 lb
		11. Rally 40WSP + mancozeb 75DF	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3 lb
		12. Rally 40WSP + Polyram 80DF	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3 lb
		13. Ziram 76DF or WDG	2 lb	6.5 lb
		14. Procure 50WS + Captan 50W	3 oz + 1 lb	12 oz + 3.25 lb
		15. Procure 50WS + mancozeb 75DF	3 oz + 1 lb	12 oz + 3 lb
		16. Procure 50WS + Polyram 80DF	3 oz + 1 lb	12 oz + 3 lb
		17. Procure 50WS + Ziram 76DF or WDG	3 oz + 1 lb	12 oz + 3.25 lb
		18. Vangard 75WG + mancozeb 75DF	- -	3 oz 3.2 lb
		19. Sovran 50WG	1.0-1.6 oz	4.0-6.4 oz
		20. Flint 50WG	-	2.0-2.5 oz
		21. Triadimefon 50DF + Dodine 65W	0.5-1 oz + 8 oz	2-4 oz + 1.5 lb
		22. Sulfur	2-3 lb	7-10 lb
		29. Scala 5SC + mancozeb 75DF	- -	5 fl oz 3.2 lb
30. Indar 2F + Captan 50W	-	8 fl oz + 3.25 lb		
31. Indar 2F + mancozeb 75DF	- -	8 fl oz + 3 lb		
32. Indar 7F + Polyram 80DF	-	8 fl oz + 3 lb		
33. Indar 2F + Ziram 76WDG	-	8 fl oz + 3 lb		

¹ See cautions under 1/4-1/2 inch green spray, p. 53.

² Excellent powdery mildew control is expected when the Rally or Rubigan is used on a 7-10 day interval for scab control. Triadimefon should give similar mildew control when applied on a 7-10 day schedule. See also comments about disease management on pages 52-54 and Table 9. Do not combine sulfur with oil or apply within 14 days of an oil spray.

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TIGHT CLUSTER - PREPINK SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Rosy apple aphid (RAA)	E = 19, 20, 21, 25 G = 5, 6, 7, 10, 11, 12, 13, 15, 24	1. Lannate 90SP 2. Guthion 50W 3. Imidan 70WSB	4 oz 8 oz 12-16 oz	12 oz 1.5 lb 2-3 lb
Green aphid (SA/AA)	E = 19, 20, 21, 25 G = 1, 5, 6, 7, 10, 12, 13, 15, 24	4. <i>Bacillus thuringiensis</i> 5. ⁴ Pounce 3.2EC or Perm-UP 3.2EC	See label -	See label 4-16 fl oz
Mites (ERM) ¹	E = 8, 9, 18 G = 10, 16, 17	6. ⁴ Ambush 25WP or Perm-UP 25WP	-	6.4-25.6 oz
Green fruitworms (GFW) ²	E = 5, 6, 7, 10, 12, 13, 14, 22, 23, 24 G = 1, 2, 3, 4, 15	7. ⁴ Asana XL or Adjourn 0.66EC 8. ⁵ Apollo 42SC	2.0-5.8 fl oz -	4.8-14.5 fl oz 4-8 fl oz
Tarnished plant bug (TPB)	E = 5, 6, 7, 10, 12, 13, 14, 15, 16, 22, 23, 24 G = 1, 2, 20, 21, 25	9. ⁶ Savey 50DF or Onager 1EC 10. ⁴ Danitol 2.4EC	See label -	3-6 oz or 12-24 fl oz 11-21 fl oz
Tentiform leafminers (TLM) ³	E = 5, 6, 7, 10, 12, 13, 14, 17, 18, 19, 20, 21, 22, 23, 24 G = 11, 15, 16	11. Aza-Direct 12. ⁴ Warrior 1CS, Lambda-Cy 1EC, Silencer 1EC or Warrior 2CS 13. ⁴ Proaxis 0.5CS 14. ⁴ Decis 1.5EC 15. Thionex 50WP or 3EC 16. Carzol 92SP 17. Vydate 2L 18. ⁷ Agri-Mek, Abba, or Temprano 0.15EC 19. Assail 30SG 20. Actara 25WG 21. Calypso 4F 22. ⁴ Battalion 0.2EC or Tombstone 2EC 23. ⁴ Baythroid XL 1EC 24. ⁴ Mustang Max 0.8EC 25. Beleaf 50SG	- - 1 lb or 21 fl oz 4-6 oz 1 pt 2.5-5 fl oz - - 0.5- 1 fl oz - - - -	1 qt 2.6- 5.1 fl oz or 1.3-2.5 fl oz 2.6-5.1 fl oz 0.9-1.9 fl oz 3 lb or 4 pt 12-16 oz 3 pt 10-20 fl oz 2.5-4.0 oz 4.5 oz 2-4 fl oz 7.0-14.1 fl oz 1.4-2.4 fl oz 1.3-4 fl oz 2-2.8 oz

¹ Where ERM eggs are abundant, *Stethorus punctum* adults will continue to move into trees. Begin regular monitoring of *Stethorus punctum* at this time.

² Early detection of GFW is important. Tap tree limbs over sheet beginning at prepink. GFW larvae will curl up (grub-like) when dislodged from tree.

³ Adult leafminers may be controlled at tight cluster, or larvae controlled at pre-pink or at petal fall.

⁴ Pyrethroids (e.g. Ambush, Adjourn, Asana XL, Battalion, Baythroid XL, Danitol, Decis, Lambda-Cy, Mustang Max, Perm-UP, Pounce, Proaxis, Silencer, Tombstone, Warrior) are highly toxic to predators. Do not use if *Stethorus punctum* have appeared in orchard.

⁵ See note (7), 1/4-1/2 inch green spray (insects).

⁶ See note (8), 1/4-1/2 inch green spray (insects).

⁷ See comments on p. 33.

PINK AND BLOOM SPRAYS¹

Diseases:

- Scab See recommendations under 1/4-1/2 inch green spray. Do not extend intervals between sprays during a prolonged pre-bloom period.
- Rusts and mildew See recommendations under tight cluster-prepink spray. PINK THROUGH PETAL FALL STAGE IS A VERY CRITICAL PERIOD TO PROTECT AGAINST QUINCE RUST IN PROBLEM ORCHARDS. Under heavy quince rust pressure, control with the strobilurin fungicides, Sovran and Flint, may be inadequate. For this reason we suggest including SI fungicides (Rally, Rubigan, Procure) during the pink to petal fall sprays. This may involve planned alternations of full sprays or selecting an SI fungicide soon after a quince rust infection.
- Fireblight Fireblight is most active during warm weather. Blossom infection is aggravated by showers which splash the blight bacteria. Apply streptomycin as needed at 0.3 lb per 100 gal dilute or 1.2 lb per acre concentrate. Streptomycin remains effective for 3 to 5 days. The effectiveness of streptomycin can be increased by including the adjuvant Regulaid at the rate of 1 pint per 100 gal of tank mix, however, the increased uptake of streptomycin with Regulaid is more likely to result in streptomycin injury.

The plant growth regulator, Apogee (prohexadione-calcium), is registered for suppression of fire blight shoot blight. Shoot blight suppression results from hardening off of vegetative shoot growth starting about 10 days after the initial Apogee application, which should be made at late bloom when active shoot growth is 1-3 inches long. Recent studies at Winchester indicate that Apogee may be tank-mixed with Agri-Mycin and Regulaid, allowing Apogee to take effect while there is residual protection from streptomycin. Apogee is not to be considered a replacement for streptomycin sprays for blossom blight control. Registered rates for Apogee are 6-12 oz/ 100 gal dilute or 24-48 oz/acre. To reduce interference from naturally occurring calcium in the water used for spraying, ammonium sulfate should be added to the tank **before** Apogee, at the same rate per 100 gal of spray mix as for Apogee. Based on research at Winchester, the combination of 6 oz of Apogee plus 6 oz of ammonium sulfate per 100 gal is suggested for moderately vigorous trees. An adjuvant such as Regulaid should be included to increase systemic uptake of Apogee. Vigorous trees might be more responsive to the 12 oz Apogee rate than to the 6 oz rate.

Shoot blight suppression is related to early hardening off of shoot tip growth within 10-14 days after bloom. Vigorous trees might benefit from further protection with additional Apogee applications in mid-season if shoot growth is resumed. Studies in WV showed that Apogee reduced shoot blight infections that occurred with hail injury in June. Do not apply more than 48 oz / A within a 21-day period. Practical usefulness of Apogee for shoot blight suppression in a given year might be estimated by the potential severity of fire blight based on the number of infection days that occurred during the bloom period, as well as tree vigor, varietal susceptibility, and disease history. Apogee treatment for shoot blight suppression would be most strongly suggested for vigorous young trees that have nearly filled their tree space. See page 136 in the plant growth regulator section for additional comments about the use of Apogee for shoot growth and fire blight suppression.

¹ See comments on fireblight under petal fall and first cover sprays pp. 58 and 61. Captan has been shown to severely reduce pollen viability in hard-to-pollinate varieties for 24-48 hours after application.

PINK SPRAYS¹

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Defoliating caterpillars ²	E = 4	1. ⁸ Lorsban or Yuma 4E	3 pt	-
Mites (ERM)	E = 5, 6	2. Guthion 50W	8 oz	1.5 lb
European apple sawfly (EAS) ⁶	E = 2, 3, 8, 9, 10, 11	3. Imidan 70WSB	12-16 oz	2-3 lb
Oriental fruit moth (OFM) ⁵	E = 2, 3, 12 G = 8, 10, 11	4. <i>Bacillus thuringiensis</i>	See label	See label
Mullein bug (MB)	E = 7, 8, 10	5. ³ Apollo 42SC		4 - 8 fl oz
Dogwood Borer (DB)	E = 1, 12 G = 8	6. ⁴ Savey 50DF or Onager 1EC	See label	3-6 oz or 12-24 fl oz
		7. Carzol 92SP	4- 6 oz	12- 16 oz
		8. ⁶ Assail 30SG	-	2.5-8.0 oz
		9. Actara 25WG	-	2.0- 5.5 oz
		10. ⁷ Calypso 4F	1- 2 fl oz	4- 8 fl oz
		11. Avaunt 30WDG	-	5-6 oz
		12. ⁸ Lorsban 75WG	10 oz	2 lb

¹ Most insecticides should not be applied during bloom. Install pheromone trap and inspect for male San Jose scale. Begin monitoring for gypsy moth.

² If defoliating caterpillars become a problem, sprays of *Bacillus thuringiensis* are acceptable, affecting neither pollination nor fruit set. However, residual life is short.

³ See note (7), 1/4-1/2 inch green spray (insects).

⁴ See note (8), 1/4-1/2 inch green spray (insects).

⁵ Apply at pink only if damage was severe in preceding year. Otherwise treat at petal fall if threshold is exceeded.

⁶ 2.5-4.0 oz/A for MB; 5.5-8.0 oz/A for EAS, OFM; 8.0 oz/A for DB as a drench to lower tree trunk.

⁷ Lower rate is effective for MB.

⁸ When applied in a handgun spray to burrknots (3 pt or 2 lb/100 gal) will provide season-long control of DB.

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PETAL FALL SPRAY (when most petals have fallen)¹

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab	E = 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 19, 20, 21, 30, 31, 32, 33 G = 2, 13 F = 22	1. Dodine 65W	8 oz	1.5 lb
		2. Captan 50W	1.5 lb	6.0 lb
		3. Rubigan 1E + Captan 50W	3 fl oz + 1 lb	9 fl oz + 3.25 lb
		4. Rubigan 1E + Dodine 65W	3 fl oz + 4 oz	8-9 fl oz + 1 lb
		5. Rubigan 1E + Ziram 76DF or WDG	3 fl oz + 1 lb	9 fl oz + 3.25 lb
Powdery Mildew ²	E = 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 19, 20, 21 G = 14, 15, 16, 17, 22, 30, 31, 32, 33	6. Rubigan 1E + mancozeb 75DF	3 fl oz + 1 lb	9 fl oz + 3 lb
		7. Rubigan 1E + Polyram 80DF	3 fl oz + 1 lb	9 fl oz + 3 lb
Rusts ⁴	E = 5, 6, 7, 8, 9, 10, 11 12, 15, 16, 17, 21, 30, 31, 32, 33 G = 3, 4, 13, 14	8. Rally 40WSP + Captan 50W	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3.25 lb
		9. Rally 40WSP + Dodine 65W	1.25-2.0 oz + 4 oz	5.0-7.5 oz + 1 lb
Fireblight	E = 23	10. Rally 40WSP + Ziram 76DF or WDG	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3.25 lb
Rots and frog-eye leaf spots	G = 2, 13, 19, 20, 30, 31, 32, 33 F = 3, 4, 5, 6, 7 8, 9, 10, 11, 12	11. Rally 40WSP + mancozeb 75DF	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3 lb
		12. Rally 40WSP + Polyram 80DF	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3 lb
		13. ³ Ziram 76DF or WDG	2 lb	6.5 lb
		14. Procure 50WS + Captan 50W	3 oz + 1 lb	12 oz + 3.25 lb
		15. Procure 50WS + mancozeb 75DF	3 oz + 1 lb	12 oz + 3 lb
		16. Procure 50WS + Polyram 80DF	3 oz + 1 lb	12 oz + 3 lb
		17. Procure 50WS + Ziram 76DF or WDG	3 oz + 1 lb	12 oz + 3.25 lb
		19. Sovran 50WG	1.0-1.6 oz	4.0-6.4 oz
		20. Flint 50WG	-	2.0-2.5 oz
		21. Triadimefon 50DF + Dodine 65W	0.5-1 oz + 8 oz	2-4 oz + 1.5 lb
		22. Sulfur	2-3 lb	7-10 lb
		23. Streptomycin	0.3 lb	1.2 lb
		30. Indar 2F + Captan 50W	- -	8 fl oz + 3.25 lb
		31. Indar 2F + Mancozeb 75DF	- -	8 fl oz + 3 lb
		32. Indar 2F + Polyram 80DF	- -	8 fl oz + 3 lb
		33. Indar 2F + Ziram 76WDG	- -	8 fl oz + 3 lb

¹ See cautions 1, 2 and 3 under 1/4-1/2 inch green spray (diseases).

² Excellent powdery mildew control is expected when the Rally or Rubigan is used on a 7-10 day interval for scab control. Triadimefon should give similar mildew control when applied on a 7-10 day schedule. See also comments about disease management in Table 6. Do not apply more than 24 oz of Triadimefon 50DF per acre per season. Do not apply more than 60 lb of Captan 50W per acre per year.

³ Do not apply more than 56 lb Ziram DF or WDG per acre per year.

⁴ See cautions about quince rust under pink and bloom sprays.

Carefully inspect flower cluster leaves for primary scab lesions. If scab lesions are present, include fungicides that have antispore activity against scab (Dodine or combinations of Topsin-M with other fungicides if resistance is not present. Repeated applications of Dodine 65W at 12 oz per 100 gal (2 lb per acre) can be used to inhibit sporulation).

Severity of powdery mildew is directly related to the amount of overwintering inoculum in shoot and blossom buds and the length of the spray interval. Check blocks of highly susceptible cultivars (Jonathan, Ginger Gold, Rome Beauty, Stayman Winesap, Idared, Paulared, Granny Smith) to determine the amount of overwintering inoculum. Mildew is active during periods of dry weather; maintaining short spray intervals (not over 7 days) more effectively reduces mildew infection than increasing fungicide rates. In serious cases, special mildew sprays applied between the regular sprays from pink through the cover sprays may be the most economical way to achieve the desired control and prevent a repeated buildup of mildew for the following year.

Late bloom is frequently the site of fireblight blossom infection. Maintain streptomycin applications to assure that the late blossoms are protected to the end of an extended bloom period on susceptible cultivars such as Jonathan, Rome Beauty, York Imperial, Golden Delicious, Idared and Gala and on trees on M. 9 and M. 26 rootstocks.

When streptomycin is combined with other pesticides it should be used at 80 PPM (0.4 lb/100 gal or 1.5 lb/A concentrate). To avoid the development of resistance to streptomycin, limit the number of applications to no more than four.

PETAL FALL SPRAY¹ (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Redbanded leafroller (RBLR) ³	E = 2, 27, 35	1. ¹⁹ Lorsban or Yuma 4E	3 pt	-
	G = 3, 4, 5, 22, 24, 36	2. ² Lannate 90SP	4 oz	12 oz
Curculio (PC) ³	E = 3, 4, 17	3. Guthion 50W	8-10 oz	1.5-2 lb
	G = 14, 15, 16, 28, 33, 36	4. Imidan 70WSB	16-21 oz	3-4 lb
Rosy apple aphid (RAA)	E = 6, 14, 15, 16, 23, 25, 33	5. <i>Bacillus thuringiensis</i>	See label	See label
	G = 2, 9, 10, 12, 36	6. Movento 2SC	-	6-9 fl oz
Oriental fruit moth (OFM)	E = 3, 4, 36	7. Apollo 42SC	-	4-8 fl oz
	G = 2, 5, 9, 14, 16, 17, 22, 24, 27, 35, 37	8. Savey 50DF or Onager 1EC	-	3-6 oz or 12-24 fl oz
Mites (ERM)	E = 7, 8, 13, 18, 29, 30, 31, 32, 34	9. Aza-Direct	-	1 qt
	G = 11, 12, 21, 26	10. Thionex 50WP or 3EC	1 lb or 21 fl oz	3 lb or 4 pt
Green fruitworms (GFW) ⁴	E = 2, 3, 4, 5, 22, 24, 27, 36	11. Carzol 92SP	6 oz	1 lb
		12. ⁷ Vydate 2L	1 pt	3 pt
Defoliating caterpillars ⁵	G = 2, 3, 4, 5, 36	13. ⁸ Agri-Mek, Abba or Temprano 0.15EC	2.5-5 fl oz	10-20 fl oz
		14. ¹⁷ Assail 30SG	-	2.5-8.0 oz
Tentiform leafminers (TLM)	E = 12, 13, 14, 15, 16, 25, 33	15. ¹⁴ Actara 25WG	-	2.0-5.5 oz
	G = 9	16. ¹⁸ Calypso 4F	1- 2 fl oz	4-8 fl oz
White apple leafhopper (WALH) ⁶	E = 2, 11, 14, 15, 16, 25, 33	17. Avaunt 30WDG	-	5-6 oz
	G = 10, 12, 13, 22, 24, 28	18. ⁹ Nexter 75WP	-	4.4-5.2 oz
Codling moth (CM)	E = 35	19. ¹⁰ Isomate-C+, CTT	not a spray	
	G = 19, 20, 37	20. Disrupt CM-Xtra	not a spray	
European apple sawfly (EAS) ¹¹	E = 3, 4, 14, 16, 17	21. Vendex 50W	6 oz	18 oz
	G = 15, 22, 24, 36	22. ¹² Sevin 50W	2 lb	6 lb
Mullein bug (MB)	E = 11, 14, 16	23. Beleaf 50SG	-	2-2.8 oz
	G = 10, 15	24. ¹² Sevin XLR PLUS	2 pt	6 pt
Dogwood borer (DB) ¹⁹	E = 1, 36	25. ¹⁴ Provado or Pasada 1.6F	1-2 fl oz	4-8 fl oz
	G = 14	26. ¹⁵ Ultra Fine oil	2 gal	
San Jose Scale (SJS)	G = 6	27. ¹⁶ Intrepid 2F	-	8-16 fl oz
		28. Surround WP	25 lb	-
		29. ⁸ Acramite 50WS	-	12-16 oz
		30. Zeal 72WDG	-	2-3 oz
		31. Portal 5EC	10 fl oz	2 pt
		32. Kanemite 15SC	-	31 fl oz
		33. Clutch 50WDG	-	3 oz
		34. Envidor 2SC	-	16-18 fl oz
		35. Rimon 0.83EC	-	20-40 fl oz
		36. ^{13,19} Lorsban 75WG	10 oz	2 lb
		37. ¹⁰ Isomate-CM/OFM TT or CheckMate CM-OFM Dual	not a spray	

¹ CAUTION: To avoid killing bees, do not spray pesticides on open blooms of trees or ground vegetation. See pesticide hazard to bees (page 41). This is an excellent time to hang pheromone traps for codling moth, and the leafroller complex to determine biofix.

² Lannate used alone does not provide control beyond 3-4 days.

³ Monitor orchards carefully for newly hatched leafroller larvae and inward migration of curculio.

⁴ GFW, if present, must be controlled at this time to prevent fruit injury (see note under tight cluster spray for monitoring method).

⁵ Climbing cutworms (a type of defoliating caterpillar) hide in ground litter during the day and feed in trees at night. Heaviest damage occurs in tree tops and ends of limbs. Cutworms may severely injure young trees. Gypsy moths hatch beginning at bloom and are dispersing into orchards at this time.

⁶ Examine undersides of leaves for newly hatched WALH nymphs. Nymphs move rapidly forward, or backward when disturbed.

⁷ Likely to thin fruit when used at this time.

⁸ See comments on p. 33.

⁹ See comments on p. 38.

¹⁰ For CM mating disruption apply earlier than conventional sprays for this pest. See note, p. 37.

¹¹ Control EAS if a problem last year, or if 5.5 adults are captured between pink and petal fall on white sticky traps if a prebloom insecticide was applied. If no prebloom insecticide was applied, use a threshold of 4.7 adults.

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- ¹² Caution should be exercised in the use of Sevin because of the potential to cause mite outbreaks. Preliminary research indicates that the XLR PLUS formulation may be less disruptive to mite management programs than other formulations.
- ¹³ Increase rate to 2 lb/100 gal for handgun application to control DB.
- ¹⁴ Lower rate is effective against WALH.
- ¹⁵ Good control of ERM may be achieved by 3 applications of Ultra-Fine oil at 2-week intervals starting at petal fall.
- ¹⁶ Use 12-16 fl oz/A for OFM control.
- ¹⁷ 2.5-4.0 oz/A for RAA, TLM, WALH, MB; 5.5-8.0 oz/A for PC, OFM, EAS; 8.0 oz/A as a drench spray to lower tree trunk. The addition of 0.5% oil will improve control of OFM if using less than 8.0 oz/A.
- ¹⁸ Low rate is effective for RAA, TLM, WALH, MB.
- ¹⁹ Handgun applications directed to burrknot-affected areas are most effective for DB. Pheromone traps may be used to determine periods of male moth activity. These traps should be hung about 6 feet off the ground. Application (up to 2 per season) is limited to the lower 4 ft of trunk from a distance of no more than 4 ft. Do not allow spray to contact fruit or foliage.

FIRST COVER SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab	E = 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 19, 20, 21, 30, 31, 32, 33 G = 2, 13 F = 22	2. Captan 50W	1.5 lb	6.0 lb
		3. Rubigan 1E + Captan 50W	3 fl oz + 1 lb	9 fl oz + 3.25 lb
		4. Rubigan 1E + Dodine 65W	3 fl oz + 4 oz	8-9 fl oz + 1 lb
		5. Rubigan 1E + Ziram 76DF or WDG	3 fl oz + 1 lb	9 fl oz + 3.25 lb
		6. Rubigan 1E + mancozeb 75DF	3 fl oz + 1 lb	9 fl oz + 3 lb
Powdery mildew ²	E = 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 19, 20, 21, 24 G = 14, 15, 16, 17, 22, 30, 31, 32, 33	7. Rubigan 1E + Polyram 80DF	3 fl oz + 1 lb	9 fl oz + 3 lb
		8. Rally 40WSP + Captan 50W	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3.25 lb
Rusts	E = 5, 6, 7, 8, 9, 10, 11, 12, 15, 16, 17, 21, 30, 31, 32, 33 G = 3, 4, 13, 14	9. Rally 40WSP + Dodine 65W	1.25-2.0 oz + 4 oz	5.0-7.5 fl oz + 1 lb
		10. Rally 40WSP + Ziram 76DF or WDG	1.25-2.0 oz + 1 lb	5.0-7.5 fl oz + 3.25 lb
Fireblight ³	E = 23	11. Rally 40WSP + mancozeb 75DF	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3 lb
Rots and frog-eye leaf spot	G = 2, 13, 19, 20, 30, 31, 32, 33 F = 3, 5, 6, 7, 8, 10, 11, 12	12. Rally 40WSP + Polyram 80DF	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3 lb
		13. Ziram 76DF or WDG	2 lb	6.5 lb
		14. Procure 50WS + Captan 50W	3 oz + 1 lb	12 oz + 3.25 lb
		15. Procure 50WS + mancozeb 75DF	3 oz + 1 lb	12 oz + 3 lb
		16. Procure 50WS + Polyram 80DF	3 oz + 1 lb	12 oz + 3 lb
		17. Procure 50WS + Ziram 76DF or WDG	3 oz + 1 lb	12 oz + 3.25 lb
		19. Sovran 50WG	1.0-1.6 oz	4.0-6.4 oz
		20. Flint 50WG	-	2.0-2.5 oz
		21. Triadimefon 50DF + Dodine 65W	0.5-1 oz + 8 oz	2-4 oz + 1.5 lb
		22. Sulfur	2-3 lb	7-10 lb
		23. Streptomycin	0.3 lb	1.2 lb
		24. Triadimefon 50DF	0.5-1 oz	2-4 oz
		30. Indar 2F + Captan 50W	- 1 lb	8 fl oz + 3.25 lb
		31. Indar 2F + Mancozeb 75DF	- 1 lb	8 fl oz + 3 lb
		32. Indar 2F + Polyram 80DF	- 1 lb	8 fl oz + 3 lb
33. Indar 2F + Ziram 76WDG	- 1 lb	8 fl oz + 3 lb		

¹ CAUTION: Do not extend the interval between sprays more than 7 days. See cautions under 1/4-1/2 inch green spray against using Captan with oil. See cautions under petal fall spray, p. 58, about scab and mildew control. In rust problem areas, maintain control for rusts until spore horns on cedar galls no longer expand when wetted.

² Excellent powdery mildew control is expected when the Rally or Rubigan is used on a 7-10 day interval for scab control. Triadimefon should give similar mildew control when applied on a 7-10 day schedule. See also comments about disease management in Table 6. Do not combine sulfur with oil or apply within 14 days of an oil spray. Do not apply more than 24 oz of Triadimefon 50DF per acre per season.

³ Streptomycin applications can reduce the incidence of fire blight in green shoots during the early cover spray period. It does not effectively reduce spread in woody shoots. Do not apply streptomycin to apples closer than 50 days to harvest. Observe the 50 day application timing on summer cultivars such as Lodi, Yellow Transparent and Gala. Where fireblight blossom and/or shoot infections are being removed during the early season cover spray period, apply streptomycin 1-3 days prior to cutting cankers. In cutting out blight infections, pruning equipment should be sterilized and all pruned cankers should be removed from the orchard. This operation may need to be repeated on a weekly basis. Better results are achieved if the pruning operation is conducted during dry weather. Good potato leafhopper control may help to reduce the spread of shoot blight. See pink and bloom spray for information about use of Apogee for shoot blight management.

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FIRST COVER SPRAY¹ (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Curculio (PC)	E = 2, 3, 13	1. Lannate 90SP	4 oz	12 oz
	G = 10, 11, 12, 22, 27	2. Guthion 50W	8-10 oz	1.5-2 lb
Mites (ERM) ²	E = 4, 5, 9, 14, 24, 25, 26, 27, 28 G = 8, 15, 20, 23	3. Imidan 70WSB	16-21 oz	3-4 lb
		4. Apollo 42 SC	-	4-8 fl oz
		5. Savey 50DF or Onager 1EC	-	3-6 oz 12-24 fl oz
White apple leafhopper (WALH)	E = 1, 10, 11, 12, 19, 27 G = 7, 8, 9, 13, 16, 18, 19	6. Aza-Direct	-	1 qt
		7. Thionex 50WP or 3EC	1 lb or 21 fl oz	3 lb or 4 pt
Codling moth (CM) ^{3, 11}	E = 2, 3, 29, 34, 37 G = 1, 6, 10, 12, 13, 16, 18, 20, 21, 33, 36	8. ⁵ Vydate 2L	1 pt	3 pt
		9. ⁶ Agri-Mek, Abba or Temprano 0.15EC	2.5-5 fl oz	10-20 fl oz
		10. ⁴ Assail 30SG	-	2.5-8.0 oz
Periodical cicada (C) ¹²	G = 1, 10, 16, 18, 22	11. ⁹ Actara 25 WG	-	2.0- 5.5 oz
		12. ⁹ Calypso 4F	1-2 fl oz	4-8 fl oz
Green aphid (SA/AA)	E = 10, 11, 12, 17, 19, 27, 35 G = 1, 7, 8	13. Avaunt 30WDG	-	5-6 oz
		14. ⁷ Nexter 75WP	-	4.4-5.2 oz
Oriental fruit moth (OFM) ^{3, 11}	E = 30, 31, 32	15. Vendex 50W	6 oz	18 oz
		16. ⁸ Sevin 50W	2 lb	6 lb
		17. Beleaf 50SG	-	2-2.8 oz
		18. ⁸ Sevin XLR PLUS	2 pt	6 pt
		19. ⁹ Provado or Pasada 1.6F	1-2 fl oz	4-8 fl oz
		20. ¹⁰ Ultra-Fine oil	2 gal	-
		21. ¹¹ Intrepid 2F	-	12-16 fl oz
		22. Surround WP	25 lb	-
		23. Acramite 50WS	-	12-16 oz
		24. Zeal 72WDG	-	2-3 oz
		25. Portal 5EC	10 fl oz	2 pt
		26. Kanemite 15SC	-	31 fl oz
		27. Clutch 50WDG	-	3 oz
		28. Envidor 2SC	-	16-18 fl oz
		29. ¹¹ Rimon 0.83EC	-	20-40 fl oz
		30. Isomate-M100	Not a spray	-
		31. CheckMate OFM-F	-	1.3-2.9 fl oz
32. Disrupt OFM	Not a spray	-		
33. CM Virus	-	6.8-13.5 fl oz (Carpovirusine) 3-6 fl oz (Cyd-X)		
34. Delegate 25WG	-	4.5-7 oz		
35. Movento 2SC	-	6.0-9.0 fl oz		
36. Belt 4SC	-	3.0-5.0 fl oz		
37. Altacor 35WDG	-	2.5-4.5 oz		

¹ The insects listed under the petal fall spray will still be present if they were not controlled at the optimum time during petal fall. Pest development varies with the conditions of each season. Temperature is a major factor, and a pest may appear as much as two weeks earlier or later in any two successive years. Monitor orchards carefully to determine pest development and best time to spray. In this guide, the first cover spray follows petal fall by 10-14 days and each successive cover spray interval is assumed to be 10-14 days.

² Mites develop resistance quickly. Rotate materials; avoid using the same or related compounds repeatedly.

³ See notes on mating disruption, p. 37.

⁴ 2.5-4.0 oz/A for WALH and SA/AA; 5.5-8.0 oz/A for PC and CM. Addition of 0.5% oil will improve control of CM if using less than 8.0 oz/A.

⁵ Likely to thin fruit when used at this time.

⁶ See comments on p. 33.

⁷ See comments on p. 38.

⁸ See note 12, p. 60.

⁹ Lower rate is effective against WALH.

¹⁰ See note 15, p. 60.

¹¹ See note on CM and OFM on p. 1-2 for timing recommendations based on DD.

¹² Although postbloom applications of pyrethroids are not recommended, they are the most effective materials for control of periodical cicada.

SECOND COVER SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab	E = 3, 5, 6, 7, 8, 10, 11, 12, 14, 15, 16, 17, 19, 20, 30, 31, 32, 33 G = 2, 13 F = 22	2. Captan 50W	1.5 lb	6.0 lb
		3. Rubigan 1E + Captan 50W	3 fl oz + 1 lb	9 fl oz + 3.25 lb
		5. Rubigan 1E + Ziram 76DF or WDG	3 fl oz + 1 lb	9 fl oz + 3.25 lb
Powdery mildew	E = 3, 5, 6, 7, 8, 10, 11, 12, 19, 20, 24 G = 14, 15, 16, 17, 22, 30, 31, 32, 33	6. Rubigan 1E + mancozeb 75DF	3 fl oz + 1 lb	9 fl oz + 3 lb
		7. Rubigan 1E + Polyram 80DF	3 fl oz + 1 lb	9 fl oz + 3 lb
Rusts	E = 5, 6, 7, 8, 10, 11, 12, 15, 16, 17, 24, 30, 31, 32, 33 G = 3, 13, 14	8. Rally 40WSP + Captan 50W	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3.25 lb
		10. Rally 40WSP + Ziram 76DF or WDG	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3.25 lb
Rots and frog-eye leaf spot	G = 2, 13, 19, 20, 30, 31, 32, 33 F = 3, 5, 6, 7, 8, 10, 11, 12	11. Rally 40WSP + mancozeb 75DF	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3 lb
		12. Rally 40WSP + Polyram 80DF	1.25-2.0 oz + 1 lb	5.0-7.5 oz + 3 lb
		13. Ziram 76DF or WDG	2 lb	6.5 lb
		14. Procure 50WS + Captan 50W	3 oz + 1 lb	12 oz + 3.25 lb
		15. Procure 50WS + mancozeb 75DF	3 oz + 1 lb	12 oz + 3 lb
		16. Procure 50WS + Polyram 80DF	3 oz + 1 lb	12 oz + 3 lb
		17. Procure 50WS + Ziram 76DF or WDG	3 oz + 1 lb	12 oz + 3.25 lb
		19. Sovran 50WG	1.0-1.6 oz	4.0-6.4 oz
		20. Flint 50WG	-	2.0-2.5 oz
		22. Sulfur	2-3 lb	7-10 lb
		24. Triadimefon 50DF	0.5-1.0 oz	2-4 oz
		30. Indar 2F + Captan 50W	-	8 fl oz + 3.25 lb
		31. Indar 2F + Mancozeb 75DF	-	8 fl oz + 3 lb
32. Indar 2F + Polyram 80DF	-	8 fl oz + 3 lb		
33. Indar 2F + Ziram 76WDG	-	8 fl oz + 3 lb		

¹ CAUTION: Do not apply more than 24 oz of Triadimefon 50DF per acre per season. In some years, primary scab and rust inoculum may be depleted by the time for the second cover spray. If this is the case and primary scab has been well controlled, the spray program should be aimed more at control of "summer diseases" including Brooks spot, sooty blotch, fly speck, and rots. If mildew is a problem, maintain mildew protection until shoot growth hardens off.

Note: Pound for pound, the EBDC fungicides are the most active fungicides available for bitter rot control. Where bitter rot has been difficult to control EBDCs should be used to their fullest advantage, approaching the allowable 77 day pre-harvest interval. Different spray schedules should be considered based on groupings of cultivars by expected harvest dates: Early cultivars - Gala and Ginger Gold; Mid-season - Red Delicious and Golden Delicious; Late season cultivars (later EBDC use permitted by calendar date - Rome, York, Fuji and Granny Smith. Note that EBDC use must not exceed 21 lb/A/yr when used later than petal fall.

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SECOND COVER SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Tentiform leafminers (TLM) (2nd generation)	E = 8, 9, 10, 11, 17, 24, 26, 32, 33, 35, 36, 39 G = 2, 6, 16	1. Esteem 35W	-	4-5 oz
		2. Lannate 90SP	4 oz	12 oz
		3. Guthion 50W	8-10 oz	1.5-2 lb
Mites (ERM/TSM) ¹	E = 13, 21, 22, 23, 25 G = 8, 14, 18, 20	4. Imidan 70WSB	16-21 oz	3-4 lb
		5. <i>Bacillus thuringiensis</i>	See label	See label
Codling moth (CM) ⁷	E = 3, 4, 26, 30, 31, 35, 39 G = 1, 2, 6, 9, 11, 12, 16, 19, 28, 38	6. Aza-Direct	-	1 qt
		7. Thionex 50WP or 3EC	1 lb or 21 fl oz	3 lb or 4 pt
		8. Vydate 2L	1 pt	3 pt
San Jose scale (SJS) ²	E = 1, 29 G = 2, 17, 34, 37	9. ⁴ Assail 30SG	-	2.5-8.0 oz
		10. Actara 25WG	-	2.0- 5.5 oz
Variegated leafroller and tufted apple budmoth (VLR + TBM) ^{3, 7}	E = 19, 26, 32, 33, 35, 36, 38, 39 G = 3, 4, 5, 16, 30, 31	11. Calypso 4F	1- 2 fl oz	4-8 fl oz
		12. Avaunt 30WDG	-	5-6 oz
Green aphid (SA/AA)	E = 9, 10, 11, 15, 17, 24, 37 G = 2, 7, 8, 30, 31	13. ⁹ Nexter 75WP	-	4.4-5.2 oz
		14. Vendex 50W	6 oz	18 oz
		15. Beleaf 50SG	-	2-2.8 oz
Oriental fruit moth (OFM) ⁷	E = 3, 4, 27, 30, 31, 35, 39 G = 2, 6, 9, 11, 12, 16, 19, 26	16. ⁵ Sevin XLR PLUS	2 pt	6 pt
		17. Provado or Pasada 1.6F	1-2 fl oz	4-8 fl oz
		18. ⁶ Ultra-Fine oil	2 gal	
Woolly apple aphid (WAA)	G = 7, 34, 37	19. ⁸ Intrepid 2F	-	8-16 fl oz
		20. Acramite 50WS	-	12-16 oz
		21. Zeal 72WDG	-	2-3 oz
		22. Portal 5EC	10 fl oz	2 pt
		23. Kanemite 15SC	-	31 fl oz
		24. Clutch 50WDG	-	3 oz
		25. Envidor 2SC	-	16-18 fl oz
		26. ⁷ Rimon 0.83EC	-	20-40 fl oz
		27. CheckMate OFM-F	-	1.3-2.9 fl oz
		28. CM Virus	-	6.8-13.5 fl oz (Carpovirusine) 3-6 fl oz (Cyd-X)
		29. Centaur 70WP	-	34.5 oz
		30. No. 2 + No. 3	2 oz + 5 oz	6 oz + 14-18 oz
		31. No. 2 + No. 4	2 oz + 10 oz	6 oz + 32 oz
		32. SpinTor 2SC	1.25-2.5 fl oz	5-10 fl oz
		33. Entrust 80WP	0.5-0.75 oz	2-3 oz
		34. Diazinon 50WP or 4E	1 lb or 1 pt	3 lb or 3 pt
		35. Delegate 25WG	-	4.5-7 oz
36. Proclaim 5SG	0.8-1.2 oz	3.2-4.8 oz		
37. Movento 2SC	-	6.0-9.0 oz		
38. Belt 4SC	-	3.0-5.0 fl oz		
39. Altacor 35WDG	-	2.5-4.5 oz		

¹ Mites are laying eggs at this time; two consecutive sprays are needed where mites are a problem and predators are not numerous enough to provide control. Continue monitoring for *Stethorus punctum*. Start monitoring *Amblyseius fallacis*, predaceous thrips, mirids, and *Orius* species.

² SJS crawlers appear now. Yellow crawlers may be detected by capturing them on a ring of black electrical tape tightly encircling a scaley branch, sticky side out. Tape should be observed and replaced every other day.

³ Members of the leafroller complex will begin laying eggs. Start looking for egg masses while monitoring orchard. Determine species present using pheromone traps.

⁴ 2.5-4.0 oz for TLM and SA/AA; 5.5-8.0 oz for CM and OFM.

⁵ See note 12, p. 60.

⁶ See note 15, p. 60.

⁷ See notes on CM, OFM, and TBM on p.1- 2 for timing recommendation based on DD.

⁸ Use 12-16 fl oz for CM and OFM control.

⁹ Use 8.8-10.7 oz/A for TSM.

THIRD COVER SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab and Mildew	See tight cluster- 2nd cover sprays	13. Ziram 76DF or WDG	2 lb	6.5-8 lb
		19. ² Sovran 50WG	1.0-1.6 oz	4.0-6.4 oz
Brooks spot	E = 19, 20, 25, 26, 28, 29 G = 13, 27	20. ² Flint 50WG	-	2.0-2.5 oz
		25. Topsin-M 70W + Captan 50W	2-3 oz + 1 lb	8-10 oz + 3-4 lb
Black rot and white rot	E = 28, 29 G = 19, 20, 25, 26, 27 F = 13	26. Topsin-M 70W + Ziram 76DF or WDG	2-3 oz + 1 lb	8-10 oz + 3-4 lb
		27. Captan 50W	2 lb	6.5-8 lb
Bitter rot	E = 29 G = 13, 19, 20, 27, 28 F = 25, 26	28. Captan 50W +	1 lb +	3-4 lb +
		29. ³ Pristine 38WG	-	14.5 oz

¹ CAUTION: Do not apply mancozeb or Polyram within 77 days of harvest. Without the broad spectrum rot control of the EBDC fungicides (mancozeb and Polyram), potential rot problems should be anticipated. Monitor orchard blocks frequently for rots, sooty blotch and fly speck. Topsin-M does not effectively control bitter rot. Do not apply more than 64 lb of Captan 50W per acre per year. Do not use more than 56 lb of Ziram 76DF per acre per year.

² Use higher rates and shorter intervals if bitter rot pressure is high. While benefits for summer disease control are recognized, ratings for rot disease are still under evaluation. Caution is advised on the use of these materials where bitter rot pressure is heavy.

³ Limit the number of applications of Pristine and similar modes of action to four/yr; do not make more than two sequential applications of Pristine before alternating to a fungicide with another mode of action.

IMPROVED CULTURAL PRACTICES FOR BETTER SUMMER DISEASE MANAGEMENT

Summer disease control without EBDC fungicides may involve more expensive but less effective spray programs. Here are some general disease management practices which do not directly involve fungicides but can improve disease control under any fungicide program:

1. Prune trees to improve spray coverage and shorten drying time. This includes removing and keeping vines out of the tree.
2. Disease inoculum reduction:
 - a. Remove prunings, cankers, dead wood from the trees.
 - b. Remove fruit mummies from the trees when feasible.
 - c. Control fireblight to reduce fruit rot fungus build-up on cankers. Fireblight-killed wood often becomes colonized by fruit rot fungi later that season. Where blighted shoots are not removed, they should be recognized as a source of increased rot pressure and the spray interval should be tightened accordingly.
 - d. Consider removing alternate hosts such as brambles, honeysuckle, etc. from rock outcroppings and ditches inside large orchard areas.
3. Be aware of and avoid thinning with NAA under cool conditions which aggravates pygmy fruit retention on cultivars such as Rome Beauty, Golden Delicious, spur Red Delicious, Fuji and Granny Smith.
4. Optimize tree nutrition to improve wound and canker healing, thereby reducing rot inoculum sources.
5. Use calcium sprays to control cork spot to reduce bitter rot build-up on affected fruit and subsequent spread to healthy fruit (especially Red Delicious and York). (See pages 146-147).
6. Prevent insect damage to reduce fruit susceptibility to rots.
7. Monitor disease-prone areas regularly and frequently. Some areas of the orchard tend to have chronic problems. Some areas may have a likely inoculum source as indicated above. Sooty blotch and fly speck usually appear first as light symptoms in lower, foggy areas.
8. Try to stay ahead of problems. Some cultivars are more prone to summer disease problems. Sooty blotch is easiest to detect on Golden Delicious. Romes have the habit of weighing down under a heavy crop load late in the season, making thorough spray coverage almost impossible. Concentrating on maintaining better control throughout the early summer months will help to compensate for this problem later in the season.

THIRD COVER SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Tentiform leafminers (TLM) (2nd generation)	E = 8, 9, 10, 11, 16, 23, 25, 30, 31, 33, 34, 37 G = 2, 6, 15	1. Esteem 35W	-	4-5 oz
		2. Lannate 90SP	4 oz	12 oz
		3. Guthion 50W	8-10 oz	1.5-2 lb
Mites (ERM/TSM) ¹	E = 13, 20, 21, 22, 24 G = 8, 14, 19	4. Imidan 70WSB	16-21 oz	3-4 lb
		5. <i>Bacillus thuringiensis</i>	See label	See label
Codling moth (CM) ⁶	E = 3, 4, 25, 28, 29, 33, 37 G = 1, 2, 6, 9, 11, 12, 15, 17, 36	6. Aza-Direct	-	1 qt
		7. Thionex 50WP or 3EC	1 lb or 21 fl oz	3 lb or 4 pt
		8. Vydate 2L	1 pt	3 pt
San Jose scale (SJS)	E = 1, 27 G = 2, 16, 32, 35	9. ⁸ Assail 30SG	-	2.5-8.0 oz
		10. ⁵ Actara 25WG	-	2.0- 5.5 oz
Variegated leafroller and tufted apple budmoth (VLR + TBM) ^{2, 6}	E = 17, 25, 30, 31, 33, 34, 36, 37 G = 3, 4, 5, 15, 28, 29	11. ⁵ Calypso 4F	1-2 fl oz	4-8 fl oz
		12. Avaunt 30WDG	-	5-6 oz
Rose leafhopper (RLH)	E = 2, 7, 9, 10, 11, 16, 23 G = 8, 12, 15, 18, 28, 29	13. ⁹ Nexter 75WP	-	4.4-5.2 oz
		14. Vendex 50W	6 oz	18 oz
Apple Maggot (AM) ³	E = 3, 4 G = 2, 9, 11, 12, 18, 28, 29, 30, 31, 32	15. ⁴ Sevin XLR PLUS	2 pt	6 pt
		16. ⁵ Provado or Pasada 1.6F	1-2 fl oz	4-8 fl oz
Oriental fruit moth (OFM) ⁶	E = 3, 4, 26, 28, 29, 33, 37 G = 2, 6, 9, 11, 12, 15, 17, 25	17. ⁷ Intrepid 2F	-	8-16 fl oz
		18. Surround WP	25 lb	-
		19. Acramite 50WS	-	12-16 oz
Woolly apple aphid (WAA)	G = 7, 32, 35	20. Zeal 72WDG	-	2-3 oz
		21. Portal 5EC	10 fl oz	2 pt
		22. Kanemite 15SC	-	31 fl oz
		23. Clutch 50WDG	-	3 oz
		24. Envidor 2SC	-	16-18 fl oz
		25. ⁶ Rimon 0.83EC	-	20-40 fl oz
		26. CheckMate OFM-F	-	1.3-2.9 fl oz
		27. Centaur 70WP	-	34.5 oz
		28. No. 2 + No. 3	2 oz + 5 oz	6 oz + 14-18 oz
		29. No. 2 + No. 4	2 oz + 10 oz	6 oz + 32 oz
		30. SpinTor 2SC	1.25-2.5 fl oz	5-10 fl oz
		31. Entrust 80WP	0.5-0.75 oz	2-3 oz
		32. Diazinon 50WP or 4E	1 lb or 1 pt	3 lb or 3 pt
		33. Delegate 25WG	-	4.5-7 oz
34. Proclaim 5SG	0.8-1.2 oz	3.2-4.8 oz		
35. Moverto 2SC	-	6.0-9.0 fl oz		
36. Belt 4SC	-	3.0-5.0 fl oz		
37. Altacor 35WDG	-	2.5-4.5 oz		

¹ Make 2 three-minute predator counts (7 days apart). Count larval and adult black ladybugs (*Stethorus punctum*). Also count number of mobile mites on 10 leaves on each date and calculate an average. Record these numbers. If the number of *S. punctum* per 3 minutes is at least 2.5 times the number of mites/leaf, biological control is likely. Abundance of other predators (predatory mites, mirids, Orius) may slightly decrease densities of *S. punctum* required for biological control.

² Leafroller eggs should now be present. Examine foliage carefully. **Sprays should be timed with degree days to coincide with larval emergence (see p.1)** Contact of egg masses with sprays containing methomyl will kill larvae within eggs. Use pheromone traps to determine male moth activity and species present.

³ AM is seldom a problem in our region, except when an abandoned orchard is nearby. Growers interested in exporting to certain countries should be prepared to control AM starting at 900 degree days above 50° F after Jan. 1.

⁴ See note 12, p. 60.

⁵ Lower rate is effective against RLH.

⁶ See notes on CM, OFM, and TBM on p.1- 2 for timing recommendations based on DD.

⁷ Use 12-16 fl oz for CM and OFM control.

⁸ 2.5-4.0 oz/A for TLM and RLH; 5.5-8.0 oz/A for CM, OFM and AM.

⁹ 8.8-10.7 oz/A for TSM.

FOURTH COVER SPRAY

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab and mildew	See tight cluster- 2nd cover sprays	13. Ziram 76DF or WDG	2 lb	6.5-8 lb
		19. ² Sovran 50WG	1.0-1.6 oz	4.0-6.4 oz
Brooks spot	E = 19, 20, 25, 26, 28, 29 G = 13, 27	20. ² Flint 50WG	-	2.0-2.5 oz
		25. Topsin-M 70W + Captan 50W	2-3 oz + 1 lb	8-10 oz + 3-4 lb
Sooty blotch and fly speck	E = 19, 20, 25, 26, 28, 29 G = 13, 27	26. Topsin-M 70W + Ziram 76DF or WDG	2-3 oz + 1 lb	8-10 oz + 3-4 lb
		27. Captan 50W	2 lb	6.5-8 lb
Black rot and white rot	E = 28, 29 G = 19, 20, 25, 26, 27 F = 13	28. Captan 50W + Ziram 76DF or WDG+	1 lb + 1 lb +	3-4 lb + 3-4 lb +
		29. ³ Pristine 38WG	2-3 oz	8-10 oz
Bitter rot	E = 29 G = 13, 19, 20, 27, 28 F = 25, 26		-	14.5 oz

¹ See cautions and summer disease management comments under third cover spray p. 65. Observe days-to-harvest limitations on all pesticides (Table 25). Do not apply mancozeb or Polyram within 77 days of harvest. Do not apply more than 30 lb active ingredient of captan per acre per year. If mildew is a problem, maintaining mildew protection until terminal shoot growth hardens off will reduce the amount of mildew that overwinters in the buds. This will reduce the severity of mildew next year. Regrowth late in the season may require additional protection to prevent heavy overwintering.

² Use higher rates and shorter intervals if bitter rot pressure is high. While benefits for summer disease control are recognized, ratings for rot diseases are still under evaluation. Caution is advised on the use of these materials where bitter rot pressure is heavy.

³ Limit the number of applications of Pristine and similar modes of action to four/yr; do not make more than two sequential applications of Pristine before alternating to a fungicide with another mode of action.

FOURTH COVER SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Redbanded leafroller (2nd brood) (RBLR)	E = 16, 24, 26, 27, 28, 29, 31, 32, 34, 35 G = 2, 3, 4, 14	1. Lannate 90SP	4 oz	12 oz
		2. Guthion 50W	8-10 oz	1.5-2.0 lb
		3. Imidan 70WSB	16-21 oz	3-4 lb
Mites (ERM) ¹	E = 12, 19, 20, 21, 23 G = 7, 13, 18	4. <i>Bacillus thuringiensis</i>	See label	See label
		5. Aza-Direct	-	1 qt
Codling moth (CM) ⁵	E = 2, 3, 24, 26, 27, 31, 35 G = 1, 5, 8, 10, 11, 14, 16, 34	6. Thionex 50WP or 3EC	1 lb or 21 fl oz	3 lb or 4 pt
		7. Vydate 2L	1 pt	3 pt
		8. ⁸ Assail 30SG	-	2.5-8.0 oz
Variegated leafroller and tufted apple budmoth (VLR + TBM) ⁵	E = 16, 24, 28, 29, 31, 32, 34, 35 G = 2, 3, 4, 14, 26, 27	9. ³ Actara 25 WG	-	2.0-5.5 oz
		10. ³ Calypso 4F	1-2 fl oz	4-8 fl oz
		11. Avaunt 30WDG	-	5-6 oz
Japanese beetle (JB)	E = 14, 17 G = 1, 8	12. ⁹ Nexter 75 WP	-	4.4-5.2 oz
		13. Vendex 50W	6 oz	18 oz
Rose leafhopper (RLH)	E = 1, 6, 8, 9, 10, 15, 22 G = 7, 11, 14, 17, 26, 27	14. ² Sevin XLR PLUS	2 pt	6 pt
Apple maggot (AM) ⁴	E = 2, 3 G = 1, 8, 10, 11, 17, 26, 27, 28, 29, 30	15. ³ Provado or Pasada 1.6F	1-2 fl oz	4-8 fl oz
		16. ⁷ Intrepid 2F	-	8-16 fl oz
		17. ⁶ Surround WP	25 lb	
Oriental fruit moth (OFM) ⁵	E = 2, 3, 25, 26, 27, 31, 35 G = 1, 5, 8, 10, 11, 14, 16, 24	18. Acramite 50WS	-	12-16 oz
		19. Zeal 72WDG	-	2-3 oz
		20. Portal 5EC	10 fl oz	2 pt
Woolly apple aphid (WAA)	G = 6, 30, 33	21. Kanemite 15SC	-	31 fl oz
		22. Clutch 50WDG	-	3 oz
		23. Envidor 2SC	-	16-18 fl oz
		24. ⁵ Rimon 0.83EC	-	20-40 fl oz
		25. CheckMate OFM-F	-	1.3-2.9 fl oz
		26. No. 1 + No. 2	2 oz + 5 oz	6 oz + 14-18 oz
		27. No. 1 + No. 3	2 oz + 10 oz	6 oz + 32 oz
		28. SpinTor 2SC	1.25 - 2.5 fl oz	5-10 fl oz
		29. Entrust 80WP	0.5- 0.75 oz	2- 3 oz
		30. Diazinon 50WP or 4E	1 lb or 1 pt	3 lb or 3 pt
		31. Delegate 25WG	-	4.5-7 oz
		32. Proclaim 5SG	0.8-1.2 oz	3.2-4.8 oz
		33. Movento 2SC	-	6-9 fl oz
		34. Belt 4SC	-	3-5 fl oz
		35. Altacor 35WG	-	2.5-4.5 oz

¹ See note 1, p. 66.² Sevin XLR Plus poses less risk to honey bees than other Sevin formulations, especially when used in concentrate sprays of 30 gallons per acre (1:39 dilution ratio). However, some additional bee safety is obtained at more dilute rates. Frequent applications may be necessary to control new immigrating Japanese beetles. Mite build up can be expected. Also see note 12, p. 60.³ Lower rate is effective against RLH.⁴ See note 3, p. 66.⁵ See note on CM, OFM, and TBM on p.1- 2 for timing recommendations based on DD.⁶ For effective control of JB, apply **BEFORE** adult activity on trees begins.⁷ Use 12-16 fl oz for CM and OFM control.⁸ 2.5-4.0 oz/A for RLH; 5.5-8.0 oz/A for CM, JB, AM and OFM.⁹ Use 8.8-10.7 oz/A for TSM.

FIFTH COVER SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab and mildew	See tight cluster to 2nd cover sprays	13. Ziram 76DF or WDG	2 lb	6.5-8 lb
		19. ² Sovran 50WG	1.0-1.6 oz	4.0-6.4 oz
Brooks spot	E = 19, 20, 25, 26, 28, 29 G = 13, 27	20. ² Flint 50WG	-	2.0-2.5 oz
		25. Topsin-M 70W + Captan 50W	2-3 oz + 1 lb	8-10 oz + 3-4 lb
Sooty blotch and fly speck	E = 19, 20, 25, 26, 28, 29 G = 13, 27	26. Topsin-M 70W + Ziram 76DF or WDG	2-3 oz + 1 lb	8-10 oz + 3-4 lb
		27. Captan 50W	2 lb	6.5-8 lb
Black rot and white rot	E = 28, 29 G = 19, 20, 25, 26, 27 F = 13	28. Captan 50W + Ziram 76DF or WDG + Topsin M 70W	1 lb + 1 lb + 2-3 oz	3-4 lb + 3-4 lb + 8-10 oz
		29. ³ Pristine 38WG	-	14.5 oz

¹ See cautions and summer disease management comments under third cover spray p. 65. Observe days-to-harvest limitations on all pesticides (Table 25). Do not apply more than 30 lb active ingredient of captan per acre per year. If mildew is a problem, maintaining mildew protection until terminal shoot growth hardens off will reduce the amount of mildew that overwinters in the buds. This will reduce the severity of mildew next year. Regrowth late in the season may require additional protection to prevent heavy overwintering.

² Use higher rates and shorter intervals if bitter rot pressure is high. While benefits for summer disease control are recognized, ratings for rot diseases are still under evaluation. Caution is advised on the use of these materials where bitter rot pressure is heavy.

³ Limit the number of applications of Pristine and similar modes of action to four/yr; do not make more than two sequential applications of Pristine before alternating to a fungicide with another mode of action.

FIFTH COVER SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Japanese beetle (JB)	E = 14, 17 G = 1, 8	1. Lannate 90SP	4 oz	12 oz
		2. Guthion 50W	8-10 oz	1.5-2 lb
Mites (ERM/TSM)	E = 12, 19, 20, 21, 23 G = 7, 13, 18	3. Imidan 70WSB	16-21 oz	3-4 lb
		4. <i>Bacillus thuringiensis</i>	See label	See label
		5. Aza-Direct	-	1 qt
Codling moth (CM) ⁶	E = 2, 3, 24, 29, 32 G = 1, 5, 8, 10, 11, 14, 16, 26, 31	6. Thionex 50WP or 3EC	1 lb or 21 fl oz	3 lb or 4 pt
		7. Vydate 2L	1 pt	3 pt
		8. ⁷ Assail 30SG	-	2.5-8.0 oz
		9. ³ Actara 25WG	-	2.0- 5.5 oz
San Jose scale (SJS) (2nd generation)	E = 27 G = 1, 15, 28, 30	10. ³ Calypso 4F	1- 2 fl oz	4- 8 fl oz
		11. Avaunt 30WDG	-	5-6 oz
White apple leafhopper (WALH)(2nd generation)	E = 1, 8, 9, 10, 15, 22 G = 6, 7, 11, 14	12. ⁵ Nexter 75WP	-	4.4-5.2 oz
		13. Vendex 50W	6 oz	18 oz
Woolly apple aphid (WAA)	G = 6, 28, 30	14. ¹ Sevin XLR PLUS	2 pt	6 pt
		15. ³ Provado or Pasada 1.6F	1-2 fl oz	4-8 fl oz
Apple maggot (AM) ²	E = 2, 3 G = 1, 8, 9, 10, 11, 17, 28	16. Intrepid 2F	-	12-16 fl oz
		17. ⁴ Surround WP	25 lb	-
Oriental fruit moth (OFM) ⁶	E = 2, 3, 25, 29, 32 G = 1, 5, 8, 10, 11, 14, 16, 24	18. Acramite 50WS	-	12-16 oz
		19. Zeal 72WDG	-	2-3 oz
		20. Portal 5EC	10 fl oz	2 pt
		21. Kanemite 15SC	-	31 fl oz
		22. Clutch 50WDG	-	3 oz
		23. Envidor 2SC	-	16-18 fl oz
		24. ⁶ Rimon 0.83EC	-	20-40 fl oz
		25. CheckMate OFM-F	-	1.3-2.9 fl oz
		26. CM Virus	-	6.8-13.5 fl oz (Carpovirusine)
		27. Centaur 70WP	-	34.5 oz
28. Diazinon 50WP or 4E	1 lb or 1 pt	3 lb or 3 pt		
29. Delegate 25WG	-	4.5-7 oz		
30. Movento 2SC	-	6-9 oz		
31. Belt 4SC	-	3-5 fl oz		
32. Altacor 35WDG	-	2.5-4.5 oz		

¹ See note 2, p. 68.

² See note 3, p. 66.

³ Lower rate is effective against WALH.

⁴ For effective control of JB, apply **BEFORE** adult activity on trees begins.

⁵ Use 8.8-10.7 oz/A for TSM.

⁶ See note on CM and OFM on p.1- 2 for timing recommendations based on DD.

⁷ Use 2.5-4.0 oz/A for WALH; 5.5-8.0 oz/A for JB, CM, AM and OFM

70 Bearing Apple Orchards

SIXTH COVER SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab and mildew	See tight cluster to 2nd cover sprays	13. Ziram 76DF or WDG	2 lb	6.5-8.0 lb
Brooks spot	E = 19, 20, 25, 26, 28, 29 G = 13, 27	19. ² Sovran 50WG 20. ² Flint 50WG	1.0-1.6 oz -	4.0-6.4 oz 2.0-2.5 oz
Sooty blotch and fly speck	E = 19, 20, 25, 26, 28, 29 G = 13, 27	25. Topsin-M 70W + Captan 50W	2-3 oz + 1 lb	8-10 oz + 3-4 lb
Black rot and white rot	E = 28, 29 G = 19, 20, 25, 26, 27 F = 13	26. Topsin-M 70W + Ziram 76DF or WDG	2-3 oz + 1 lb	8-10 oz + 3-4 lb
Bitter rot	E = 29 G = 13, 19, 20, 27, 28 F = 25, 26	27. Captan 50W 28. Captan 50W + Ziram 76 DF or WDG+ Topsin M 70W 29. ³ Pristine 38WG	2 lb 1 lb + 1 lb + 2-3 oz -	6.5-8.0 lb 3-4 lb + 3-4 lb + 8-10 oz 14.5 oz

¹ See cautions and summer disease management comments under third cover spray p. 65. Observe days-to-harvest limitations on all pesticides (Table 25). Do not apply more than 30 lb active ingredient of captan per acre per year. If mildew is a problem, maintaining mildew protection until terminal shoot growth hardens off will reduce the amount of mildew that overwinters in the buds. This will reduce the severity of mildew next year. Regrowth late in the season may require additional protection to prevent heavy overwintering.

² Use higher rates and shorter intervals if bitter rot pressure is high. While benefits for summer disease control are recognized, ratings for rot diseases are still under evaluation. Caution is advised on the use of these materials where bitter rot pressure is heavy.

³ Limit the number of applications of Pristine and similar modes of action to four/yr; do not make more than two sequential applications of Pristine before alternating to a fungicide with another mode of action.

SIXTH COVER SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Mites (ERM/TSM)	E = 12, 20, 21, 22, 24 G = 7, 13, 19	1. Lannate 90SP 2. Guthion 50W 3. Imidan 70WSB	4 oz 8-10 oz 16-21 oz	12 oz 1.5-2 lb 3-4 lb
Codling moth (CM) ^{1,7}	E = 2, 3, 25, 32, 35 G = 1, 5, 8, 10, 11, 15, 17, 27, 34	4. <i>Bacillus thuringiensis</i> 5. Aza-Direct 6. Thionex 50WP or 3EC 7. Vydate 2L	See label - 1.0 lb or 21.0 fl oz 1 pt	See label 1 qt 3 lb or 4 pt 3 pt
White apple leafhopper (WALH) (2nd generation), Rose leafhopper (RLH) (2nd generation)	E = 1, 8, 9, 10, 16, 23 G = 6, 7, 11, 15, 18	8. ² Assail 30SG 9. ⁴ Actara 25WG 10. ⁴ Calypto 4F 11. Avaunt 30WDG	- - 1-2 fl oz -	2.5-8.0 oz 2.0-5.5 oz 4- 8 fl oz 5-6 oz
San Jose scale (SJS) (2nd generation)	E = 28 G = 1, 16, 31, 33	12. ⁶ Nexter 75WP 13. Vendex 50W 14. Pyrellin	- 6 oz 12 fl oz	4.4-5.2 oz 18 oz 2 pt
Tentiform leafminers (TLM)	E = 7, 8, 9, 10, 16, 23, 25, 29, 30, 32, 35 G = 1, 5, 15	15. ³ Sevin XLR PLUS 16. ⁴ Provado or Pasada 1.6F 17. Intrepid 2F	2 pt 1-2 fl oz -	6 pt 4-8 fl oz 12-16 fl oz
Woolly apple aphid (WAA)	G = 6, 31, 33	18. Surround WP 19. Acramite 50WS 20. Zeal 72WDG	25 lb - -	- 12-16 oz 2-3 oz
Apple maggot (AM) ⁵	E = 2, 3 G = 1, 8, 10, 11, 18, 29, 30, 31	21. Portal 5EC 22. Kanemite 15SC 23. Clutch 50WDG	10 fl oz - -	2 pt 31 fl oz 3 oz
Oriental fruit moth (OFM) ⁷	E = 2, 3, 26, 32, 35 G = 1, 5, 8, 10, 11, 15, 17, 25	24. Envidor 2SC 25. Rimon 0.83EC 26. Checkmate OFM-F 27. CM Virus 28. Centaur 70WP 29. SpinTor 2SC 30. Entrust 80WP 31. Diazinon 50WP or 4E 32. Delegate 25WG 33. Movento 2SC 34. Belt 4SC 35. Altacor 35WDG	- - - - - 1.25-2.5 fl oz 0.5-0.75 oz 1 lb or 1 pt - - - - - -	16-18 fl oz 20-40 fl oz 1.3-2.9 fl oz 6.8-13.5 fl oz (Carpovirusine) 3-6 fl oz (Cyd-X) 34.5 oz 5-10 fl oz 2-3 oz 3 lb or 3 pt 4.5-7 oz 6-9 fl oz 3-5 fl oz 2.5-4.5 oz

¹ Examine fruit for injury by second generation larvae, and monitor with pheromone traps to determine need for third generation control.

² 2.5-4.0 oz/A for WALH, RLH; 5.5-8.0 oz/A for CM, AM and OFM.

³ See note 2, p. 68.

⁴ Lower rate is effective against leafhoppers.

⁵ See note 3, p. 66.

⁶ Use 8.8- 10.7 oz/A for TSM.

⁷ See note on CM and OFM on p.1- 2 for timing recommendations based on DD.

SEVENTH AND EIGHTH COVER SPRAYS¹

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab and mildew	See tight cluster to 2nd cover sprays	13. Ziram 76DF or WDG 19. ² Sovran 50WG	2 lb 1.0-1.6 oz	6.5-8 lb 4.0-6.4 oz
Brooks spot	E = 19, 20, 25, 26, 28, 29 G = 13, 27	20. ² Flint 50WG 25. Topsin-M 70W + Captan 50W	- 2-3 oz + 1 lb	2.0-3.0 oz 8-10 oz + 3-4 lb
Sooty blotch and fly speck	E = 19, 20, 25, 26, 28, 29 G = 13, 27	26. Topsin-M 70W + Ziram 76DF or WDG	2-3 oz + 1 lb	8-10 oz + 3-4 lb
Black rot and white rot	E = 28, 29 G = 19, 20, 25, 26, 27 F = 13	27. Captan 50W 28. Captan 50W + Ziram 76 DF or WDG+	2 lb 1 lb + 1 lb +	6.5-8 lb 3-4 lb + 3-4 lb +
Bitter rot	E = 29 G = 13, 19, 20, 27, 28 F = 25, 26	Topsin M 70W 29. ³ Pristine 38WG	2-3 oz -	8-10 oz 14.5 oz

¹ See cautions and summer disease management comments under third cover spray p. 65. Observe days-to-harvest limitations on all pesticides (Table 25). Do not apply more than 30 lb active ingredient of captan per acre per year. If mildew is a problem, maintaining mildew protection until terminal shoot growth hardens off will reduce the amount of mildew that overwinters in the buds. This will reduce the severity of mildew next year. Regrowth late in the season may require additional protection to prevent heavy overwintering.

² Use higher rates and shorter intervals if bitter rot pressure is high. While benefits for summer disease control are recognized, ratings for rot diseases are still under evaluation. Caution is advised on the use of these materials where bitter rot pressure is heavy.

³ Limit the number of applications of Pristine and similar modes of action to four/yr; do not make more than two sequential applications of Pristine before alternating to a fungicide with another mode of action. Use of Pristine at this time may reduce the amount of post-harvest rot.

SEVENTH AND EIGHTH COVER SPRAYS (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Mites (ERM/TSM) ¹	E = 12, 20, 21, 22, 24 G = 7, 13, 19	1. Lannate 90SP	4 oz	12 oz
Codling moth (CM) ⁷	E = 2, 3, 25, 28, 29, 33, 37 G = 1, 5, 8, 10, 11, 15, 17, 36	2. Guthion 50W	8-10 oz	1.5-2 lb
San Jose scale (SJS) (2nd generation)	E = 27 G = 1, 16, 32, 35	3. Imidan 70WSB	16-21 oz	3-4 lb
Leafrollers (VLR + TBM 2nd generation) (RBLR, 3rd generation) ^{2,7}	E = 17, 25, 30, 31, 33, 34 36, 37 G = 2, 3, 4, 15, 28, 29	4. <i>Bacillus thuringiensis</i>	See label	See label
White apple leafhopper (WALH) (2nd generation) Rose leafhopper (RLH) (2nd generation)	E = 1, 8, 9, 10, 16, 23 G = 6, 7, 11, 15, 18, 28, 29	5. Aza-Direct	-	1 qt
Tentiform leafminers (TLM) (3rd generation)	E = 7, 8, 9, 10, 16, 23, 25, 30, 31, 33, 34, 37 G = 1, 5, 15	6. Thionex 50WP or 3EC	1 lb or 21 fl oz	3 lb or 3 pt
Apple maggot (AM) ⁵	E = 2, 3 G = 1, 8, 10, 11, 18, 30, 31, 32	7. Vydate 2L	1 pt	3 pt
Oriental fruit moth (OFM) ⁷	E = 2, 3, 26, 33, 37 G = 1, 5, 8, 10, 11, 15, 17, 25	8. ⁸ Assail 30SG	-	2.5-8.0 oz
Stink bugs (SB) ¹⁰	G = 1, 2, 6, 8, 9, 10	9. ⁴ Actara 25WG	-	2.0- 5.5 oz
Woolly apple aphid (WAA)	G = 6, 32, 35	10. ⁴ Calypso 4F	1-2 fl oz	4- 8 fl oz
		11. Avaunt 30WDG	-	5-6 oz
		12. ⁹ Nexter 75WP	-	4.4- 5.2 oz
		13. Vendex 50W	6 oz	18 oz
		14. Pyrelin	12 fl oz	2 pt
		15. ³ Sevin XLR PLUS	2 pt	6 pt
		16. ⁴ Provado or Pasada 1.6F	1-2 fl oz	4-8 fl oz
		17. ⁶ Intrepid 2F	-	8-16 fl oz
		18. Surround WP	25 lb	
		19. Acramite 50WS	-	12-16 oz
		20. Zeal 72WG	-	2-3 oz
		21. Portal 5EC	10 fl oz	2 pt
		22. Kanemite 15SC	-	31 fl oz
		23. Clutch 50WDG	-	3 oz
		24. Envitor 2SC	-	16-18 fl oz
		25. ⁷ Rimon 0.83EC	-	20-40 fl oz
		26. CheckMate OFM-F	-	1.3-2.9 fl oz
		27. Centaur 70WP	-	34.5 oz
		28. No. 1 + No. 2	2 oz + 5 oz	6 oz + 14-18 oz
		29. No. 1 + No. 3	2 oz + 10 oz	6 oz + 32 oz
		30. SpinTor 2SC	1.25-2.5 fl oz	5-10 fl oz
		31. Entrust 80WP	0.5-0.75 oz	2-3 oz
		32. Diazinon 50WP or 4EC	1 lb or 1 pt	3 lb or 3 pt
		33. Delegate 25WG	-	4.5-7 oz
		34. Proclaim 5SG	0.8-1.2 oz	3.2-4.8 oz
		35. Movento 2SC	-	6-9 fl oz
		36. Belt 4SC	-	3-5 fl oz
		37. Altacor 35WDG	-	2.5-4.5 oz

¹ If mite predators are present, carefully consider the need to control mites this late in the season. Unless they are abundant enough to prevent fruit sizing, or to cause discomfort to pickers, it may be advisable to protect the predators for the next year. Vydate and Vendex have low toxicity to *S. punctum* larvae and adults. Nexter is moderately toxic to *S. punctum* larvae and adults. Most of these miticides are moderately or highly toxic to predaceous mites.

² Monitor VLR + TBM male moths with pheromone traps. Monitor eggs and larvae by visual examination. Concentrate search on south side of tree below 5 feet. Time sprays with degree days to coincide with egg hatch. Follow restrictions on minimum days between last spray and harvest (Table 25).

³ See note 2, p. 68.

⁴ Lower rate is effective against leafhoppers and TLM.

⁵ See note 3, p. 66.

⁶ Use 12-16 fl oz for CM and OFM control.

⁷ See notes on CM, OFM, and TBM on p.1- 2 for timing recommendations based on DD.

⁸ 2.5-4.0 oz/A for WALH, RLH and TLM; 5.5-8.0 oz/A for CM, AM and OFM.

⁹ Use 8.8-10.7 oz/A for TSM.

¹⁰ Although postbloom applications of pyrethroids are not recommended, they are the most effective materials for control of SB.

POSTHARVEST DISEASE AND FRUIT SCALD CONTROL¹

SUGGESTED CHEMICALS² Fungicides	100 GAL DILUTE
Mertect 340F + Captan 50W (thiabendazole)	1 pt + 1 lb
Scholar 50W	8-16 oz ³
Penbotec 400SC	1-2 qt

² It is recommended that one of these fungicide treatments be included if fruit must be dipped in a scald inhibitor. If fruit do not need to be treated for scald inhibition, prompt movement into storage with rapid cooling and no fungicide treatment is another option.

³ A rate of 6 oz in 25-100 gal may be used as a dilute application or dip for control of blue mold and gray mold.

SCALD INHIBITORS

Variety	Early Maturity	Middle Maturity	Late Maturity
Red Delicious	2000 ppm DPA	2000 ppm DPA	2000 ppm DPA
Stayman, Rome, York, Granny Smith	2000 ppm DPA	1000 ppm DPA	

¹ Based on minimum days after full bloom considered safe for picking apples for storage: Red Delicious, 135-145 (depending on strain); Stayman and York, 160; Rome, 165. DPA = Diphenylamine.

Fungicide and scald inhibitor should be applied by flooding or dipping apples after harvest. Additional water with appropriate amounts of chemical must occasionally be added to the holding tank to replace that used in treating the fruit.

Fungicides: The chemical suspension should be recharged with additional material after 600 bushels have been treated. As a general guideline, approximately 15 percent of the initial amount of each material should be added again plus the additional amount needed to replace the volume of suspension lost during treatment. Such recharging of the mixture may be done two times before being discarded. The chemical suspension should be discarded after approximately 1000-1500 bushels have been treated with 100 gallons of mixture or if the mixture becomes dirty.

CAUTION: To prevent infection of fruit in the dip tank by strains of rot fungi resistant to thiabendazole, captan should always be mixed with this material. Do not treat with thiabendazole for more than 3 minutes.

DO NOT USE CAPTAN AS A POSTHARVEST TREATMENT ON FRUIT THAT IS TO BE SHIPPED TO CANADA.

Scald inhibitors: It is important that adequate levels of DPA be maintained in drencher or dip tanks by recharging with inhibitors and water. Tanks should be drained and cleaned at the end of each week. This will provide an opportunity to change mixtures to accommodate changing varieties and maturities. DPA has been known to cause peel injury on Golden Delicious, however, scald is usually not severe on Golden Delicious.

Thorough fruit coverage is necessary for proper scald control, but do not treat for longer than 3 minutes. Treat after harvest and before storage for maximum scald control. Coverage is less effective with cold fruit or cold solutions. Fruit should be treated only once with the same scald inhibitor to avoid exceeding residue tolerance. After treatment, it is a good practice to tilt bins to remove liquid collected in the ends of fruit and in bin bottoms. Read and follow label instructions carefully for use of scald inhibitors.

Check regularly for possible scald development during storage whether or not a scald inhibitor is used. Apple samples from the earliest picked fruit should be taken out of storage each month starting in December. Hold samples one week at room temperature. If scald is a problem in early picked lots of fruit, samples from later pickings should also be taken and checked for scald development. When samples from a given lot of apples begin to show scald, that lot of fruit should be marketed without delay if intended for fresh market.

74 Nonbearing Orchards

NONBEARING APPLE ORCHARDS

Effectiveness rating: E = excellent, G = good, F = Fair

FIRST SPRAY (Green tip - 1/2 inch green)

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab	G	Ziram 76DF or WDG	1.5 lb	5 lb
	G	Thiram 65W	2 lb	5 lb
	G	Sulfur	5 lb	13 lb

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
San Jose Scale (SJS)	E = 1	1. Superior oil	2 gal	See note. ¹
Rosy apple aphid (RAA)	G = 1			
Green aphids (SA/AA) ¹	G = 1			
Mites (ERM)	G = 1			

¹ Control of aphids with superior oil is best when application is made close to bud break. If mites are the problem, this oil spray should be applied close to the pink stage (of bearing trees) for best control. In calculating pesticide rate per acre on small trees, use tree row volume method (p. 131). See insect note 1, p. 52.

CAUTION: Do not use sulfur within 14 days of an oil spray or in combination with oil.

SECOND SPRAY (Pink stage of bearing trees)¹

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab	E = 1	1. Dodine 65W +	6 oz +	1.3 lb +
		Ziram 76DF or WDG+	10 oz +	2.0 lb +
Mildew ²	G = 1	Sulfur	2 lb active ingredient	7 lb active ingredient
Rusts ³	F = 1			

¹ The primary objective in disease control on young trees is to maintain the foliage and shoots in good condition so that normal growth and bud development will not be impaired. As trees approach the bearing age, a stronger control program may be required to ensure that disease inoculum levels do not build up so high that the first fruit crops cannot be adequately protected.

² If mildew is a serious problem, raise the sulfur rate to 3 lb per 100 gal.

³ Where cedar-apple rust is a serious problem, consider one of the combinations involving Triadimefon, Rally or Rubigan listed for bearing trees during the pink to second cover spray.

SECOND SPRAY (Pink stage of bearing trees) (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Rosy apple aphid (RAA)	G = 3, 5	1. Superior Oil	2 gal	See insect note 1, page 74.
Green aphids (SA/AA)	G = 5	2. Vendex 50W	6 oz	
Mites (ERM) ¹	E = 1, 2, 6	3. Lorsban 75WG	10 oz	
Leafrollers and other leaf feeders ²	G = 3, 4	4. Guthion 50W	8 oz	
		5. Thionex 50WP or 3EC	1 lb or 21 fl oz	
		6. Carzol 92 SP	6 oz	

¹ See note 2, p. 62.

² Use pheromone traps to determine species present and period of moth activity.

THIRD SPRAY (During blossoming of bearing trees)¹

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab, Rusts, and mildew	See recommendations under second spray, p. 74.			
Fireblight	<p>On susceptible cultivars, and cultivars on Mark, M.9 and M.26 rootstocks, it is important to prevent fireblight from becoming established on bloom of young trees. In the year the trees are planted, blossoms can be removed by hand or protected by copper sprays registered for application during bloom. In subsequent non-bearing years, dormant copper sprays and copper formulations registered for application during bloom are recommended. If compatibility of copper with other spray materials is questionable, or if fruit russetting is a concern, substitute streptomycin.</p>			

FOURTH SPRAY (when most of the petals have fallen on bearing trees)¹

Disease	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab, mildew, rusts, fireblight	See second spray, p. 74.			

¹ CAUTION: In blocks having a few blossoms, use streptomycin for fireblight control if conditions are favorable for infection. This spray timing is important to reduce spread of shoot blight, scab, and mildew epidemics. Monitor young orchards to avoid serious outbreaks of these diseases.

76 Nonbearing Orchards

FOURTH SPRAY (when most of the petals have fallen on bearing trees)¹ (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Rosy apple aphid (RAA)	E = 5, 7, 8, 9, 10, 12, 13 G = 1, 3	1. Lorsban 75WG	10 oz	See Insect note 1, page 74.
		2. Guthion 50W	8 oz	
Green aphids (SA/AA)	E = 5, 7, 8, 9, 10, 12, 13 G = 3	3. Thionex 50WP or 3EC	1 lb or 21 fl oz	
Leafrollers ²	G = 1, 2, 6	4. Carzol 92SP	6 oz	
White apple leafhopper (WALH)	E = 4, 7, 8, 9, 10, 12 G = 3, 11	5. Beleaf 50SG	0.5 oz	
		6. Imidan 70WSB	12-16 oz	
		7. Provado or Pasada 1.6F	1-2 fl oz	
		8. Assail 30SG	2.5 oz	
		9. Actara 25WG	1.5 oz	
		10. Calypso 4F	1 fl oz	
		11. Surround WP	25 lb	
		12. Clutch 50WDG	1 oz	
		13. Movento 2SC	2-3 fl oz	

¹ Avoid spraying any open bloom on trees or ground covers with insecticides.

² Use pheromone traps to determine species present and period of moth activity.

COVER SPRAYS

(14-21 day intervals after petal fall, until terminal growth ceases)

Diseases	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Scab, rusts, mildew	See second spray, p. 74.			

COVER SPRAYS¹

(14-21 day intervals after petal fall, until terminal growth ceases)

Insects/Mites	Effectiveness	Suggested Chemicals	100 gal Dilute	Acre Concentrate
Mites (ERM/TSM)	E = 5, 20, 21, 23, 24, 25, 26 G = 1	1. Vendex 50W	6 oz	See Insect note 1, page 74.
		2. ⁵ Lorsban 75WG	10 oz	
Variegated leafroller and tufted apple budmoth (VLR + TBM)	E = 14, 15, 16, 27, 28, 29 G = 2, 3, 6, 17	3. Guthion 50W	8 oz	
		4. Thionex 50WP or 3EC	1 lb or 21 fl oz	
Leafhoppers (WALH/RLH)	E = 5, 7, 8, 9, 10, 12, 13, 14, 15, 16 G = 4, 11, 18, 19	5. Carzol 92SP	6 oz	
		6. Imidan 70WSB	12-16 oz	
Defoliating caterpillars	E = 14, 15, 16, 27, 28, 29 G = 2, 3, 6, 17	7. Provado or Pasada 1.6F	1-2 fl oz	
		8. Assail 30SG	2.5 oz	
Periodical cicada (C)	G = 8, 11, 13, 18, 19	9. Actara 25WG	1.5 oz	
Japanese beetle (JB)	E = 11, 18, 19 G = 8, 13	10. Calypso 4F	1 fl oz	
Dogwood borers (DB) ²	E = 2, 22 G = 8	11. Surround WP	25 lb	
		12. Clutch 50WDG	1 oz	
		13. Lannate 90SP	4 oz	
		14. No. 13 + No. 3	2 oz + 4 oz	
		15. No. 13 + No. 6	2 oz + 6-8 oz	
		16. No. 13 + No. 2	2 oz + 6 oz	
		17. <i>Bacillus thuringiensis</i>	SEE LABEL	
		18. ³ Sevin 50W	2 lb	
		19. ³ Sevin XLR PLUS	2 pt	
		20. ⁴ Nexter 75WP	2.2 oz	
		21. Omite 30WS	2 lb	
		22. Lorsban or Yuma 4E	3 pt	
		23. Envidor 2SC	6 fl oz	
		24. Acramite 50WS	4-5 oz	
		25. Zeal 72WDG	1 oz	
		26. Portal 5EC	10 fl oz	
		27. Delegate 25 WG	2 oz	
		28. Altacor 35WDG	1 oz	
		29 Belt 4SC	1.5 fl oz	

¹ Orchards should be examined frequently from bloom until the trees harden off. Early detection of pests and prompt control measures during the period when trees are becoming established is very important. Frequent sprays may be necessary to control migrating Japanese beetles, cicadas or gypsy moths in outbreak years.

² See note 20, p. 60.

³ Sevin XLR PLUS poses less risk to honey bees than other Sevin formulations. Caution should be exercised in the use of Sevin because of the potential to cause mite outbreaks. Preliminary research indicates that the XLR PLUS formulation may be less disruptive to mite management programs than other formulations.

⁴ Use 3 oz/100 gal for TSM.

⁵ See note 13, p. 60.

FIGURE 1A. INSECT LIFE CYCLE

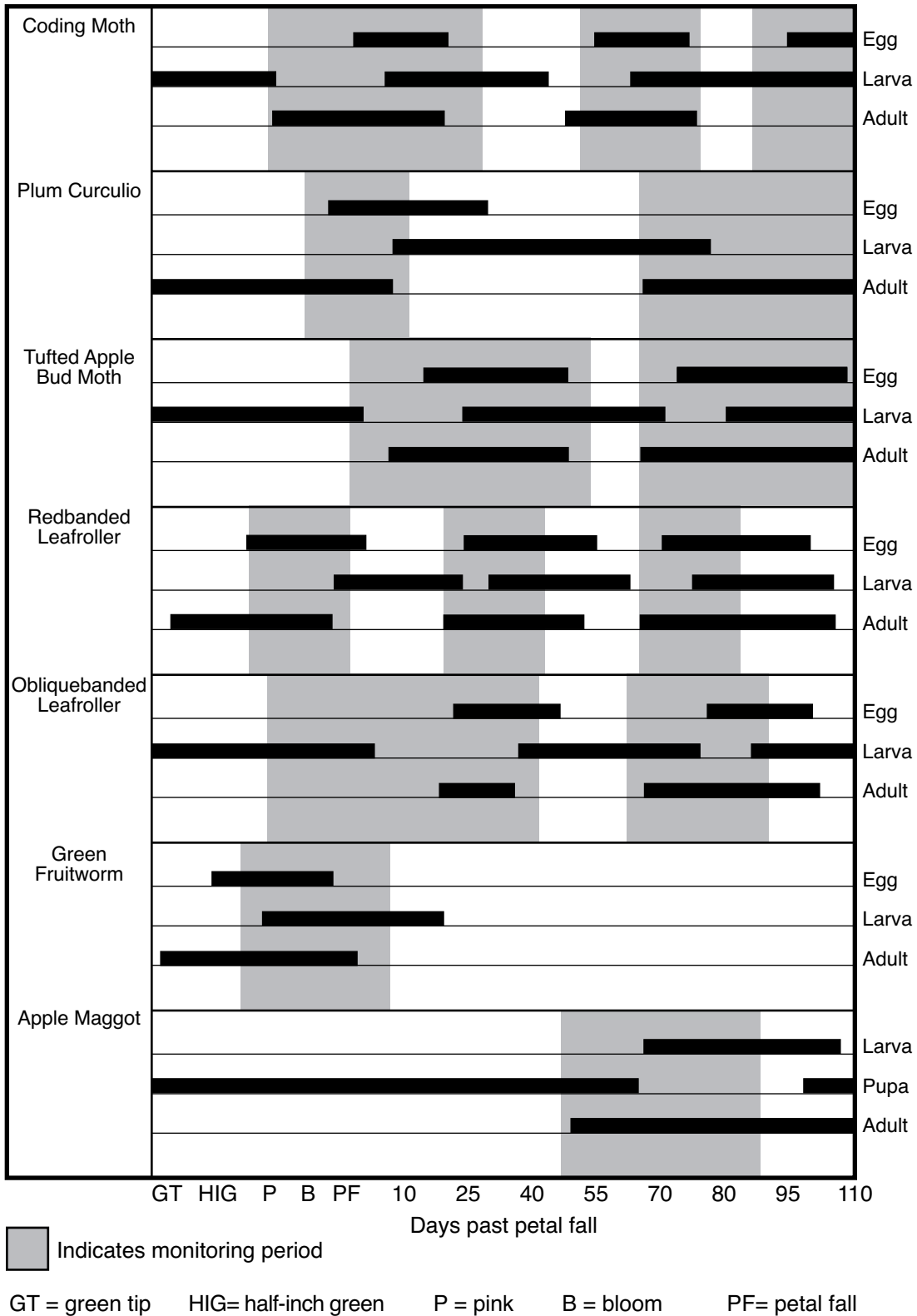


FIGURE 1 B. INSECT LIFE CYCLES

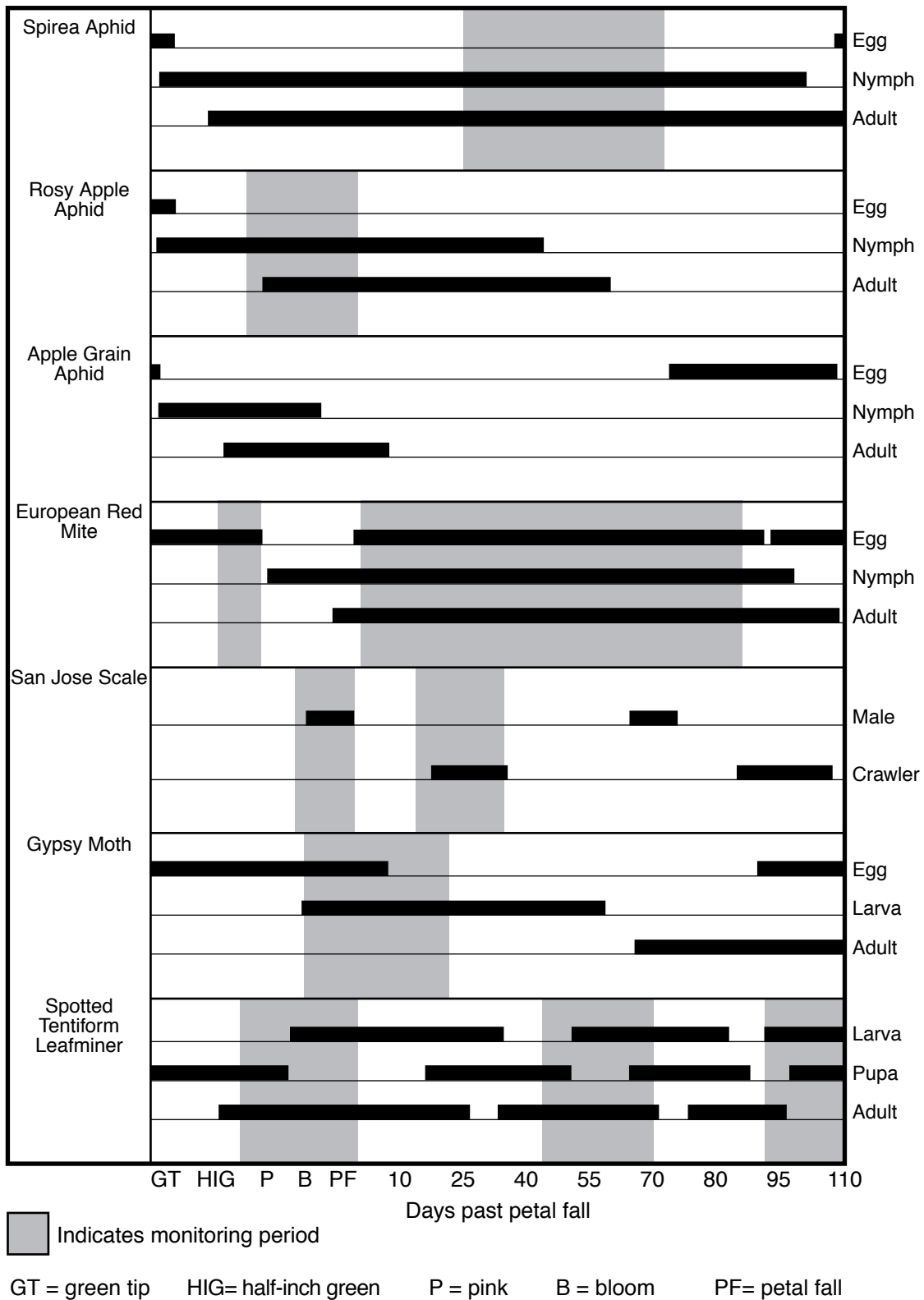
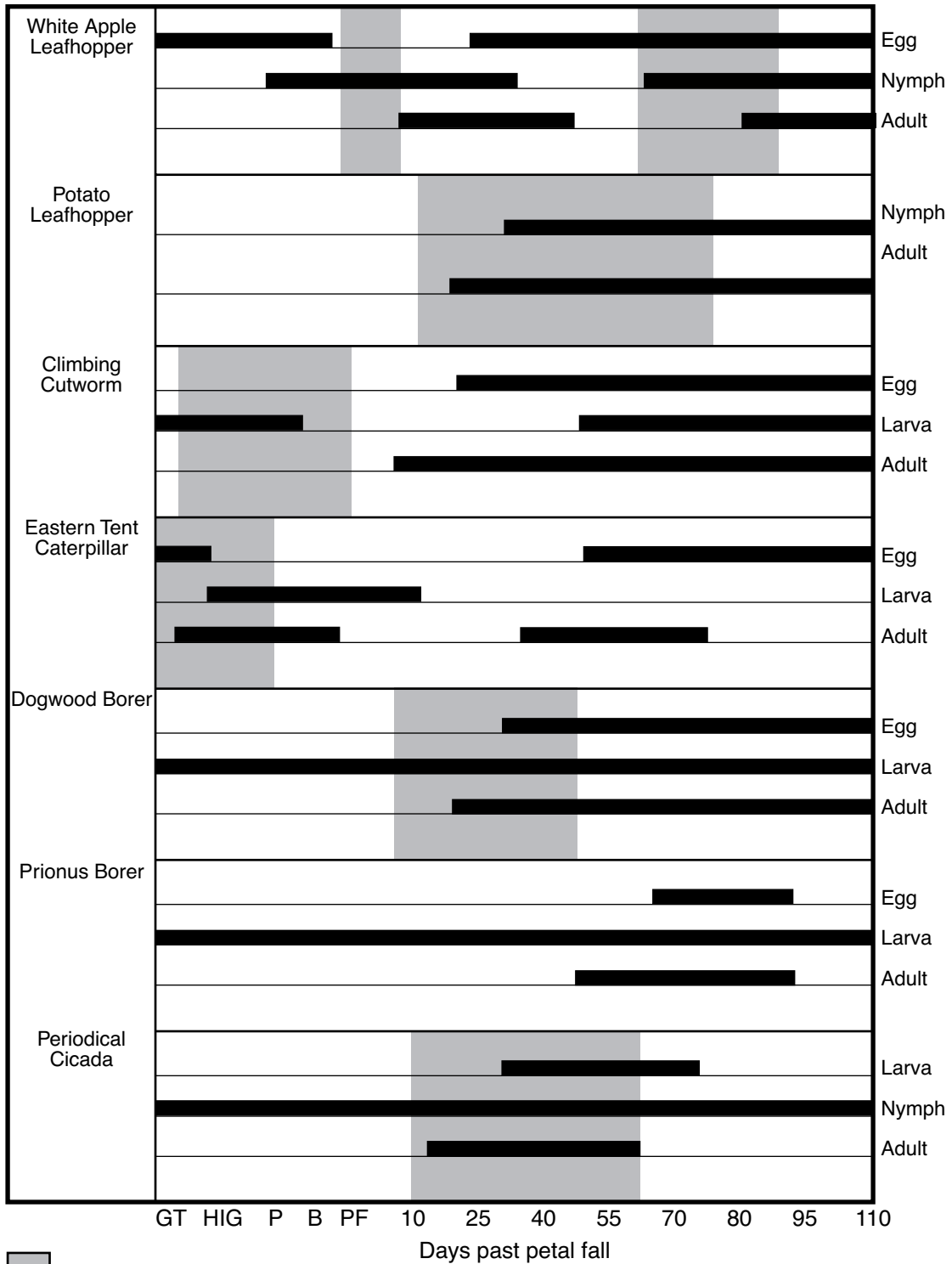


FIGURE 1 C. INSECT LIFE CYCLES



█ Indicates monitoring period

GT = green tip HIG= half-inch green P = pink B = bloom PF= petal fall

Table 9. Seasonal Activity of Apple Diseases

Initial infection possible (+); observable symptoms (S); secondary infection (*)

	scab	powdery mildew	cedar apple rust	quince rust	fireblight	moldy core	frogeye/black rot	Brooks spot	sooty blotch and fly speck	bitter and white rots
green tip	+									
tight cluster	+	+ S	+							
pink	+	+ S	+	+			+			
bloom	+ S*	+ S*	+	+	+		+ S			
petal fall	S*	+ S*	+ S	+	+ S		+ S			
1st cover	S*	S*	+ S	+ S	+ S*	+	+ S			
2nd cover	S*	S*	+ S	S	S*		+ S	+		+
3rd cover	S*	S*	S	S	S*	S	S	+		+
4th cover	S*	S*	S	S	S	S	S*	+ S		+ S
5th cover	S*	S*	S	S	S	S	S*	S	+ S	+ S*
6th cover	S*	S*	S	S	S	S	S*	S	+ S	+ S*
7th cover	S*	S*	S	S	S	S	S*	S	S*	+ S*
8th cover	S*	S*	S	S	S	S	S*	S	S*	S*

Note: Date for development of diseases may vary more than a month from year to year and by location in Virginia, West Virginia, and Maryland.

Table 10. Approximate wetting periods required for primary apple scab infection at different air temperatures and time required for development of conidia^a

Average Temperature	Wetting period (hr) ^b			Incubation period ^c (days)
	Light Infection	Moderate Infection	Heavy Infection	
78	13	17	26	...
77	11	14	21	...
76	9.5	12	19	...
63-75	9	12	18	9
62	9	12	19	10
61	9	13	20	10
60	9.5	13	20	11
59	10	13	21	12
58	10	14	21	12
57	10	14	22	13
56	11	15	22	13
55	11	16	24	14
54	11.5	16	24	14
53	12	17	25	15
52	12	18	26	15
51	13	18	27	16
50	14	19	29	16
49	14	20	30	17
48	15	20	30	17
47	15	23	35	...
46	16	24	37	...
45	17	26	40	...
44	19	28	43	...
43	21	30	47	...
42	23	33	50	...
41	26	37	53	...
40	29	41	56	...
39	33	45	60	...
38	37	50	64	...
37	41	55	68	...
33-36	48	72	96	...

^a Adapted from Mills, 1944, as modified by A. L. Jones.

^b The wetting period is determined from the beginning of the rainfall.

^c Approximate number of days required for development of conidia after the start of an infection period.

Supplementary Apple Disease Discussions

APPLE SCAB

The apple scab fungus overwinters in the previous year's infected leaves on the orchard floor. In the spring, usually around the time of bud break, ascospores are formed and released during periods of rain. The occurrence of infection depends upon the length of the wetting period and the average temperature during the wetting period. This relationship is outlined in Table 10.

Infections of new tissue by ascospores produced from last year's leaves are termed primary infections. Olive-green lesions appear on new leaves or flower parts 10-28 days after a primary infection has occurred. These lesions produce a second type of spore, termed conidia or summer spores, which are spread by splashing rain and wind, and which reinfect the leaves and developing fruit. This type of infection is termed secondary infection. The occurrence of secondary infection also depends upon the length of the wetting period and the average temperature.

To determine whether or not an infection period has occurred, you must note the time from the start of a rain until the time the foliage dries. This interval is the wetting period. Calculate the average temperature during the wetting period and check Table 10 to determine if leaves were wet long enough for an infection to occur. Environmental monitoring devices that record temperature, leaf wetness, and relative humidity are very reliable and relatively inexpensive.

Periods of dew or high humidity (over 90%) will also lengthen a wetting period if preceded by rain. Calculate the average temperature for the wetting period starting at the beginning of a rain. For example, if it rains at 4:00 p.m. and stops at 9:00 p.m., and the leaves remain wet all night with dew, the total wetting period is calculated from the 4:00 p.m. rain until the dew dries the next morning. If dew occurs at 11:00 p.m. and it rains at 6:00 a.m. the next morning, the wetting period is calculated from 6:00 a.m. until the leaves are dry.

Wet periods during intermittent rains should be added together to determine the total length of the wetting period unless these shorter wet periods are separated by 10 hours or more of dry, sunny weather.

As the length of the wetting period exceeds the minimum amount of time required for infection, the severity of the infection period becomes greater. For example, if leaves are wet for 8 hours and the average temperature is 50° F, no infection period has occurred. However, if the leaves are wet for 14 hours at this temperature, a light primary infection period has occurred. At the same temperature, wet periods of 19 and 29 hours are needed to initiate moderate and heavy primary infection periods, respectively.

Apple scab is controlled with fungicides such as the protectants (Captan, EBDCs, Ziram) and strobilurins (Flint, Sovran), APs (Vanguard, Scala), sterol inhibitors (Rally, Rubigan, Procure), and dodine. Sterol inhibitors, dodine, and especially the benzimidazoles (Topsin, Topsin-M) must be used in fungicide programs that consider the presence or the potential occurrence of strains of the fungus that are resistant to these materials. Fungicide control programs for apple scab are integrated early in the season with control measures for powdery mildew and rusts, and later in the season with control measures for summer diseases such as sooty blotch, fly speck, Brooks spot and fruit rots. For control of primary infections, sprays are usually timed according to tree phenology (growth stages), with the first spray at 1/2 inch green and additional sprays at tight cluster, full pink, bloom, and petal fall. The number of sprays needed before petal fall varies with weather conditions, cultivar, rate of tissue development, fungicide used, and density of ascospore inoculum present in the orchard. Cover sprays are applied beginning 1 week after petal fall and are repeated every 10-14 days until 2-3 weeks prior to harvest. Primary scab inoculum is usually depleted by the time of the second cover spray.

Weather forecasts can be used to modify the timing of spray applications in calendar-based schedules. For example, protective fungicides are applied only when extended wetting periods are forecast, thus extending the intervals of application during dry weather and decreasing them during wet weather. To achieve the greatest efficiency from weather-based programs, growers must be aware of the rate of tree development and how quickly fungicide residues are being lost by weathering. Control programs based on a post-infection schedule are an alternative to calendar-based and weather forecast-based schedules. To use a postinfection schedule, a grower must know when an infection period has occurred and what fungicides control scab within 24-96 hours after the initiation of an infection period. The grower must be able to cover the entire acreage within this time interval or risk control failure. Therefore, this type of program may only be suitable for well-equipped operations, although extended weather conditions unfavorable for spraying could pose a risk to even the well-equipped grower. Postinfection applications are used in modified calendar-based schedules when critical sprays are missed because of incorrect weather forecasts or unfavorable conditions for spraying.

The efficient use of fungicides is a concept that is still evolving within the industry. For example, spraying alternate row-middles on a 5-day schedule rather than spraying every row middle on a 7-day schedule increases efficiency and improves disease control. Growers also may adjust for differences in tree size from orchard to orchard by determining the amount of fungicide from the volume of foliage per acre (tree-row-volume method). The former standard of 400 gallons of water per acre for large trees on standard rootstocks may eventually be replaced completely by more efficient practices for smaller, higher-density trees.

Several sanitation and cultural practices help to reduce the risks of severe scab infection. Orchard spacing should be such that trees are far enough apart to facilitate air movement and rapid drying of trees when they are mature. Trees should be pruned regularly so that their interiors are relatively open, to enhance the drying of foliage and improve spray coverage.

A fall application of urea is suggested as a means of reducing the overwintering inoculum of the apple scab fungus and offsetting the potential for development of resistance to fungicides. Apply urea to the tree and orchard floor near leaf drop at the rate of 40 lb per acre.

FIRE BLIGHT IN APPLES AND PEARS – P. W. STEINER (DECEASED)

Fire blight is one of the most destructive and difficult to control diseases of apples and pears in the mid-Atlantic region. It also appears to be becoming more common and causing more significant tree losses in young apple orchards planted at high densities using clonal rootstocks in combination with susceptible cultivars. The disease develops in several phases, not all of which occur every year in every orchard or with equal intensity. Managing fire blight well requires an aggressive approach aimed at limiting the number and distribution of inoculum sources before and during the growing season and in preventing primary infections.

The fire blight bacterium, *Erwinia amylovora*, overwinters in the healthy bark tissue surrounding limb and twig cankers established the previous season. In the spring, as the daily average temperature increases and early bud development begins mobilizing stored carbohydrates, the overwintering bacteria multiply and initiate new infections in bark tissues at about 90-96 cumulative degree days above 55°F after green tip (approx. tight cluster to open cluster stage of spur bud development). Symptoms of these first infections won't be apparent until several weeks after bloom, but this early activity produces many bacteria which are then extruded onto bark surfaces as ooze in the weeks before flowering begins. These exposed bacteria continue to multiply and are dispersed again and again throughout the orchard by rain and insects. Thus, unlike apple scab where inoculum dispersal occurs immediately prior to infection, the fire blight pathogen can be dispersed widely to bark and bud tissues for several weeks to a month before flowering begins and the first blossom infections occur.

Once flowering begins, honey bees serve as very effective vectors in carrying the bacteria to nearly all open flowers in and around the orchard site. The rate at which flowers are colonized by the pathogen and, hence, at risk for infection if rain or dew occurs increases exponentially at temperatures above 64°F. If no rain or dew occurs during bloom, few if any blossom infections occur. If rain or dew does occur when the average daily temperature is 60°F or higher, infections can occur within minutes in flowers already colonized by the bacteria. Thus, the early dispersal of bacteria, their colonization of flowers in advance of any wetting that triggers an infection event and the very short time required to establish infections all help explain why blossom blight epidemics develop so explosively in some years. The minimum requirements for blossom infection and the order in which they must occur are: 1) flowers must be open with petals intact (flowers in petal fall are resistant); 2) an accumulation of at least 198 degree hours above 65°F; 3) a wetting event as dew or rain; and, 4) an average daily temperature of 60°F. The more any one or more of these minimum requirements is exceeded (e.g., many open flowers, more than 200 cumulative degree hours, extended rains and average temperatures above 65°F) the more severe the epidemic will be.

In addition to the direct loss of infected spurs resulting from blossom blight, the sudden availability of thousands of new sources of inoculum greatly increases the chances for many shoot infections, which can lead to additional limb and tree losses. Regardless of whether blossom blight occurs or whether large numbers of shoot blight symptoms develop, the presence of active cankers within or near an orchard can provide enough bacteria to support colonization of apple and pear foliage in an orchard by early to midsummer. Under normal conditions this epiphytic colonization poses no problem. However, should hail or wind storms damage the foliage, widespread and often severe trauma blight symptoms affecting all tissues can occur.

High density apple orchards where either the M-26 or M-9 clonal rootstock is used with any of the highly susceptible cultivars (Gala, Fuji, Braeburn, Rome, Jonathan, Ida Red, Ginger Gold, Jonagold, etc.) are at high risk for significant tree losses from fire blight when cankers develop on the rootstock. Even a few blossom or shoot blight strikes on the scion variety provide sufficient bacteria that then move rapidly through the healthy tree stem (i.e., without causing visible damage or symptoms) into the root where they initiate cankers that expand quickly, killing the entire trees within one to several months. Rootstock infections can also occur where Red Delicious, a normal blight resistant scion, develops trauma blight symptoms following hail or wind damage. Some rootstock infections also occur with the M-7A rootstock, but these are never as aggressive as those on M-26 and M-9 and seldom completely girdle and kill trees.

While it is impossible to totally eradicate fire blight to the extent that it no longer occurs, there are a number of tactics that, if followed rigorously, can reduce the frequency of serious outbreaks and provide more consistent and cost-effective control. Because fire blight develops in different phases, the strategies and tactics needed for control also are different (see Table 11).

Table 11. Aggressive Fire Blight Management

Timing	Tactics and basis for treatment
Dormant season	Thorough pruning to remove all blighted limbs and shoots every year reduces the number and distribution of canker sites available the following spring. Complete removal of severely damaged trees and replanting may be more cost-effective than retraining and allowing potential inoculum sources to remain.
Pre-bloom period	Include a copper formulation with the oil at green tip; later copper applications may damage foliage and fruit. Treat entire orchard blocks, not just susceptible varieties. The purpose of this treatment is to prevent or reduce the colonization of tree surfaces by the bacteria before bloom. Full block treatments are necessary since the bacteria also colonize resistant varieties from which the bacteria then can be dispersed to susceptible varieties during bloom.
Bloom period	Apply streptomycin (plus surfactant) just before an anticipated infection event when infection risk is moderate to high. Treat again in 4 days if high risk conditions persist. Do not exceed four antibiotic sprays per year. Make blossom treatments strictly on whether an infection event is expected or has occurred, not on how severe that event might be. The fire blight forecasting program, MARYBLYT™ can aid in these decisions. Consider applying Apogee to reduce the threat of shoot blight on vigorous trees of susceptible varieties that have nearly filled their tree space. The ideal timing of application for this purpose is at late bloom when active shoot growth is 1-3 inches long.
Postbloom through bud set	Control sucking insect pests to reduce the incidence of shoot blight. Monitor orchards closely for early blight symptoms and remove these promptly before extensive necrosis develops. Use the “ugly stub” method for blight removal. Several cutting tours may be needed to limit the number and distribution of inoculum sources for shoot blight and subsequent canker formation. Do not use streptomycin after symptoms develop or to control shoot blight since it is not effective and increases the risk for developing resistance. Avoid extensive cutting that may stimulate vegetative replacement growth and lengthen the period of shoot blight susceptibility. Shoot blight susceptibility of vigorous trees may be reduced by additional Apogee applications if shoot growth resumes in mid-season.
Late season	Although the risk for infection during the late season is relatively low, severe weather storms can still trigger a trauma blight incident, especially if blight has occurred earlier in the season. Late-season shoot blight seldom causes severe damage and is often ignored. These strikes, however, should be cut out promptly.

Streptomycin treatments and resistance. The antibiotic, streptomycin, works best in limiting the multiplication of bacteria, not in killing large populations. Also, only those blossoms open at the time of the application are protected against infection. Thus, it is most effective when it is applied as a thorough coverage spray (either low volume or high volume when coverage is adequate throughout the tree) just before an anticipated infection event. The addition of an activator-type surfactant (Regulaid, Ortho X-77, Widespread, LI-700, etc.) will improve coverage and penetration of the flower structure, especially the nectaries where most infections occur. Once treated, an open blossom is protected until petal fall when it becomes naturally resistant. Sprays applied too late are not effective in stopping infections already in progress, and those applied too early afford no protection for new flowers opening after treatment. Because thorough coverage is required, these treatments should not be made on an alternate row middle basis as is commonly done for other diseases and insect pests. Streptomycin is not effective in preventing shoot blight and should not be used for that purpose.

Resistance to streptomycin has been reported from many locations in the U.S.. In nearly all cases, however, such resistance has developed only where six or more sprays are used per year. Where growers have routinely limited the number of sprays to four or less, the product appears to remain effective even after 20-30 years use. Because of the manner in which streptomycin resistance develops in a population it should not be used repeatedly after symptoms first appear since this is more likely to encourage the selection of resistant strains.

Using Apogee to manage shoot blight. The plant growth regulator, Apogee (prohexadione-calcium), is a new tool for management of shoot blight that may reduce the threat of development of resistance to streptomycin. Apogee causes shoots to start hardening off beginning about 10 days after application, resulting in reduced susceptibility to shoot tip infection. For shoot blight suppression, Apogee should be applied at late bloom when active shoot growth is 1-3 inches long. Recent studies at Winchester indicate that Apogee may be safely tank-mixed with Agri-Mycin and Regulaid, allowing Apogee to take effect while there is residual protection from streptomycin. Registered rates for Apogee are 6-12 oz/ 100 gal dilute or 24-48 oz/acre. To reduce interference from naturally occurring calcium in the water used for spraying, ammonium sulfate should be added to the tank **before** Apogee, at the same rate per 100 gal of spray mix as for Apogee. Based on research at Winchester, the combination of 6 oz of Apogee plus 6 oz of ammonium sulfate per 100 gal is suggested for moderately vigorous trees. An adjuvant such as Regulaid should be included to increase systemic uptake of Apogee. (Further testing may indicate the suitability of other water conditioners). Vigorous trees might be more responsive to the 12 oz Apogee rate than to the 6 oz rate.

Because shoot blight suppression is related to early hardening off and continued suppression of shoot tip growth, vigorous trees might benefit from additional Apogee applications if shoot growth is resumed in mid-season. Studies in WV showed that Apogee reduced shoot blight infections that occurred with hail injury in June. Apogee should not be expected to provide a satisfactory growth response in time to be beneficial when applied after hail injury has occurred. However, it might be possible to predict its usefulness for shoot blight suppression if the year is marked by frequent Maryblyt™ infection periods during bloom and the potential threat of severe shoot tip infection under high secondary inoculum conditions. Apogee is not to be considered a replacement for streptomycin sprays for blossom blight control. Other situations in which Apogee should be most beneficial include vigorous trees and susceptible varieties. Apogee treatment for shoot blight suppression would be most strongly suggested for vigorous young trees that have nearly filled their tree space. Apogee must be further tested to determine whether its application will reduce the progression of fire blight bacteria into the rootstock.

Cutting out active fire blight strikes. Cutting out fire blight strikes while an epidemic is in progress is often controversial. Where symptoms of fire blight are severe and widespread, extensive cutting should not be done except as a salvage effort to limit the invasion of the central tree structure. Where outbreaks of fire blight are light to moderate or are limited to isolated areas within a larger orchard, however, the prompt removal of all blighted tissues can be beneficial. Recent research on both apples and pears indicates that sterilizing pruning tools prior to each cut is not useful because the bacteria often are present internally in mature bark well in advance of symptom margins. Cutting shoots or limbs to remove symptoms appears to breach the natural defense mechanisms active in mature tissues so that a small canker then develops around the cut stub. For this reason, if cuts are made back to the next healthy branch union, as is usually recommended, the small canker that forms will remain in place and provide inoculum for the following season. By making the cut into at least 2-year-old wood and leaving a 3- to 4-inch, naked, “ugly stub”, however, the stub and its small tip canker can then be removed safely and completely during the dormant pruning operation so that cankers are not left in the trees.

Forecasting fire blight. *MARYBLYT™* is an easy to use computer program that uses daily temperature and rainfall to define the risks, predict fire blight infection events, predict symptom appearance and to prompt treatment decisions. This program was developed and validated with cooperation from fruit pathologists in the mid-Atlantic region and throughout the U.S.

88 *Apple Diseases*

PHYTOPHTHORA COLLAR ROT

In Virginia and West Virginia, *Phytophthora* collar rot is the major root/crown disease of apple. The fungus causes a canker with dead bark in the root or crown area. Typically, the canker begins on the roots and advances up the trunk, usually stopping near the graft union unless the scion is highly susceptible. In some cases laboratory isolation of the *Phytophthora* fungus can provide a positive diagnosis but this is not always possible. Wherever girdling-type symptoms are observed, several other potential causes should also be considered. These include voles, borers in burr knots, mechanical injury, graft union necrosis on Red Delicious on MM.106 roots, and fireblight on M.26 or M.9 roots.

Phytophthora growth and infection are facilitated by water. The fungus produces a zoospore that can swim in a film of water to sites of infection on the crown and roots, and is thus favored by heavy, poorly drained soils.

The likelihood of collar rot occurrence can be reduced by several cultural practices:

1. Although most rootstocks can be infected in poor situations, MM. 106 and M.26 are considered very susceptible.
2. Avoid wet sites and heavy clay soils. Improve subsurface drainage.
3. Some drainage problems can be associated with planting method. Do not plant a tree more than 2-3 inches deeper than it grew in the nursery. With auger planting, avoid drilling the hole too deep, resulting in a waterlogged hole and deep planting. Cross-drainage may help to drain low spots in the furrow left by a tree planter.
4. Check nursery stock for root lesions.
5. Provide tree support as needed early in the life of the tree to reduce root and crown injury from wind rocking.

Cultural practices may be supplemented with chemical control. Materials registered for bearing trees include cupric hydroxide (Kocide), mefenoxam (Ridomil Gold EC), and Aliette WDG. Options for non-bearing orchard trees are Kocide, Ridomil 2E or Ridomil 5G, Ridomil Gold EC, and fosetyl-Al (Aliette 80WDG). Aliette 80WDG is also registered as a pre-plant root dip treatment. Check the labels for up-to-date registration and application instructions.

PEARS

Chemical effectiveness rating: E = excellent, G = good

DORMANT SPRAY

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Fireblight	G	Copper:		
		C-O-C-S 50WDG	2-4 lb	—
		Kocide DF	2-4 lb	—
		Bordeaux mixture (copper sulfate + agricultural spray lime) 325 mesh ¹	8 lb + 8 lb	— —
		Various copper formulations See label		

¹ See page 25 for mixing instructions for Bordeaux. Caution: Suggested where fireblight was difficult to control during previous year. DO NOT APPLY AFTER GREEN IS SHOWING.

DORMANT-GREEN TIP SPRAY

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Pear psylla (PP) ¹	E = 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13 G = 5, 6	1. Superior oil	2 gal	6 gal
		2. Asana XL or Adjourn 0.66EC	3 fl oz	9 fl oz
		3. Perm-UP 3.2EC or Pounce 3.2EC	-	12-16 fl oz
		4. Perm-UP 25WP or Ambush 25WP	-	19-25.6 oz
		5. Thionex 50WP or 3EC	1.5 lb or 1 qt	5 lb or 3.3 qt
		6. Lorsban 3.8E, Nufos 4E, Yuma 4E, or Lorsban 75WG	1 pt or 10 oz	2.5 pt or 2 lb
		7. Surround WP	25 lb	-
		8. Danitol 2.4EC	-	16-21 fl oz
		9. Warrior 1CS, Lambda-Cy 1EC, Silencer 1EC, or Warrior 2CS	-	2.6-5.1 fl oz or 1.3-2.5 fl oz
		10. Proaxis 0.5CS	-	2.6-5.1 fl oz
		11. Esteem 35WP	-	5 oz
		12. Dimilin 2L	-	40-48 fl oz
		13. Mustang Max 0.8EC	-	4 fl oz

¹ Examine buds with hand lens. Apply first spray when tiny yellow oval eggs are found - usually at bud swell. The addition of Superior oil to any of the insecticides above will increase their effectiveness.

GREEN CLUSTER BUD SPRAY

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Scab	E = 1, 2, 3	1. Topsin-M 70W Mancozeb 75DF	4 oz + 1 lb	1 lb + 3 lb
Leaf spot	E = 1, 2, 4	2. Topsin-M 70W Ziram 76DF or WDG	4 oz + 1 lb	1 lb + 3 lb
		3. Rubigan 1E	3 fl oz	9 fl oz
		4. Ziram 76DF or WDG	1.5-2 lb	6-8 lb

GREEN CLUSTER BUD SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Pear psylla (PP)	E = 1, 2, 3, 4, 7, 8, 9, 10, 11, 12, 13, 15, 18, 19 G = 5, 6	1. Superior oil 2. Asana XL or Adjourn 0.66 EC	2 gal 3 fl oz	6 gal 9 fl oz
San Jose Scale (SJS)	E = 1, 6, 15	3. Perm-UP 3.2EC or Pounce 3.2EC	-	12-16 fl oz
Tarnished plant bug (TPB) ¹	E = 2, 3, 4, 8, 9, 10, 14, 16, 17, 19, 21 G = 5, 7, 11, 13, 22	4. Perm-UP 25WP or Ambush 25WP	-	19-25.6 oz
Climbing cutworms (CC) ²	E = 2, 3, 4, 8, 9, 10, 14, 16, 17, 19, 21 G = 5, 6	5. Thionex 50WP or 3EC 6. Lorsban 3.8E, Nufos 4E, Yuma 4E, or Lorsban 75WG 7. Surround WP 8. Danitol 2.4EC 9. Warrior 1CS, Lambda-Cy 1EC, Silencer 1EC, or Warrior 2CS 10. Proaxis 0.5CS 11. Actara 25WG 12. Assail 30SG 13. Calypso 4F 14. Decis 1.5EC 15. Esteem 35WP 16. Battalion 0.2EC 17. Baythroid XL 1EC or Tombstone 2EC 18. Dimilin 2L 19. Mustang Max 0.8EC 20. Beleaf 50SG 21. Bifenture 2EC	1.5 lb or 1qt 1 pt or 10 oz 25 lb - - - - - - - - - - - - - - - - - -	5 lb or 3.3 qt 2.5 pt or 2 lb - 16-21 fl oz 2.6-5.1 fl oz or 1.3-2.5 fl oz 2.6-5.1 fl oz 5.5 oz 8 oz 4-8 fl oz 1.9 fl oz 5 oz 7.0-14.1 fl oz 2.0-2.4 fl oz 40-48 fl oz 4 fl oz 2-2.8 oz 2.6-12.8 fl oz

¹ Monitor appearance of TPB by jarring tree limbs over a sheet placed on the ground; TPB will fall from limbs to sheet.

² CC feed in trees at night and hide in ground cover during the day.

WHITE BUD (POPCORN) SPRAY

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Scab	E = 1, 2, 3, 4	1. Topsin-M 70W Mancozeb 75DF	4 oz + 1 lb	1 lb + 3 lb
Leaf spot	E = 1, 2, 4	2. Topsin-M 70W Ziram 76DF or WDG	4 oz + 1 lb	1 lb + 3 lb
Fireblight ¹	G = 5	3. Rubigan 1E 4. Ziram 76DF or WDG 5. Streptomycin	3 fl oz 1.5-2 lb 6.5 oz (80 ppm)	9 fl oz 6-8 lb 1.5 lb

¹ CAUTION: FIREBLIGHT. The conditions favorable for fireblight include all of the following: (1) open blossoms and succulent young growth; (2) a temperature of 65°F or higher; and (3) rainfall, or a relative humidity of 60% or higher. Apply the first streptomycin spray just before the earliest blossoms open and repeat at 5-day intervals until petals on latest blossoms have fallen. If streptomycin is applied alone, the rate may be reduced to 60 ppm (5 oz/100 gal dilute; 15 oz/A concentrate). The effectiveness of streptomycin can be increased by including the adjuvant Regulaid at the rate of 1 pint per 100 gal of tank mix. Apply streptomycin in at least 50 gallons of water per acre.

WHITE BUD (POPCORN) SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Pear psylla (PP)	E = 1, 2, 3, 5, 6, 7, 8, 9, 10, 17, 20, 21 G = 4, 12	1. ¹ Asana XL or Adjourn 0.66 EC	3 fl oz	9 fl oz
		2. ¹ Perm-UP 3.2EC or Pounce 3.2EC	-	12-16 fl oz
Tarnished plant bug (TPB)	E = 1, 2, 3, 6, 7, 8, 11, 13, 18, 19, 21, 23 G = 4, 5, 10, 22	3. ¹ Ambush 25WP or Perm-UP 25WP	-	19-25.6 oz
		4. Thionex 50WP or 3EC	1.5 lb or 1 qt	5 lb or 3.3 qt
Green fruitworms (GFW)	E = 1, 2, 3, 6, 7, 8, 11, 18, 19, 21, 23 G = 4	5. Surround WP	25 lb	-
		6. ¹ Danitol 2.4EC	-	16-21 fl oz
Mites (ERM)	E = 13, 15, 16 G = 6, 14	7. ¹ Warrior 1CS, Lambda-Cy 1EC, Silencer 1EC, or Warrior 2CS	-	2.6-5.1 fl oz or 1.3-2.5 fl oz
		8. Proaxis 0.5CS	-	2.6-5.1 fl oz
		9. Assail 30SG	-	8.0 oz
		10. Calypso 4F	1-2 fl oz	4-8 fl oz
		11. Decis 1.5 EC	-	1.9 fl oz
		12. Imidan 70WSB	1 lb	3.5 lb
		13. Carzol 92SP	6 oz	1 lb
		14. Vendex 50W	6 oz	18 oz
		15. ² Apollo 42SC	-	4-8 fl oz
		16. ² Savey 50DF or Onager 1EC	-	3-6 oz or 12-24 fl oz
		17. Esteem 35WP	-	5 oz
		18. Battalion 0.2EC	-	7.0-14.1 fl oz
		19. Baythroid XL 1EC or Tombstone 2EC	-	2.0-2.4 fl oz
		20. Dimilin 2L	-	40.0-48.0 fl oz
		21. Mustang Max 0.8EC	-	4 fl oz
		22. Beleaf 50SG	-	2-2.8 oz
		23. Bifenture 2EC	-	2.6-12.8 fl oz

¹ Pyrethroids may be applied no more than twice during the prebloom period. Monitor ERM closely postbloom because these products are highly toxic to predators of ERM.

² Apply only once per season, when eggs or young mites are present.

BLOOM SPRAY

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Scab	E = 1, 2, 3, 4	1. Topsin-M 70W	4 oz +	1 lb +
		Mancozeb 75DF	1 lb	3 lb
Leaf spot	E = 1, 2, 4	2. Topsin-M 70W	4 oz +	1 lb +
		Ziram 76DF or WDG	1 lb	3 lb
Fireblight ¹	G = 5	3. Rubigan 1E	3 fl oz	9 fl oz
		4. Ziram 76DF or WDG	1.5-2 lb	6-8 lb
		5. Streptomycin	6.5 oz (80 ppm)	1.5 lb

¹ CAUTION: See cautions about fireblight control under white bud spray.

WARNING - DO NOT APPLY INSECTICIDES DURING BLOOM.**PETAL FALL, FIRST THROUGH FIFTH COVER SPRAYS**

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Scab	E = 2, 6, 7	2. Topsin-M 70W ² Ziram 76DF or WDG	4 oz + 1 lb	1 lb + 3 lb
Leaf spot	G = 2, 4	4. ² Ziram 76DF or WDG	1.5-2 lb	6-8 lb
Fireblight ¹	G = 5	5. Streptomycin	6.5 oz (80 ppm)	1.5 lb
Sooty blotch and fly speck	E = 6, 7	6. Flint 50WG 7. Sovran 50WG 8. ³ Pristine 38WG	- 1.0-1.6 oz -	2.-2.5 oz 4.0-6.4 oz 14.5 oz

¹ CAUTION: See cautions about fireblight control under white bud spray. Do not apply streptomycin closer than 30 days to harvest. Use of more than four streptomycin sprays per year may lead to streptomycin-resistant fireblight bacteria.

² Do not apply more than 56 lb per acre per year of Ziram 76DF.

³ Limit the number of applications of Pristine, Flint and Sovran and similar modes of action to four per year. Do not make more than two sequential applications of Pristine before alternating to a fungicide with another mode of action.

PETAL FALL, FIRST THROUGH FIFTH COVER SPRAYS (cont.)

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Pear psylla (PP) ¹	E = 2, 3, 4, 10, 11, 12, 19, 24 G = 1, 5, 13, 22, 27	1. Thionex 50WP or 3EC 2. Surround WP 3. Assail 30SG	1.5 lb or 1 qt 25 lb -	5 lb ¹ or 3.3 qt - 5.5-8.0 oz
Tarnished plant bug (TPB)	E = 6 G = 1, 2, 4, 23	4. Calypso 4F 5. Imidan 70WSB	1-2 fl oz 1 lb	4-8 fl oz 3.5 lb
Stink bugs (SB)	E = 6 G = 1, 2, 23	6. ² Carzol 92SP 7. Vendex 50W	6 oz 6 oz	1 lb 18 oz
Mites (ERM/TSM)	E = 6, 8, 9, 11, 12, 18, 19, 20, 21 G = 7, 17	8. ³ Apollo 42SC 9. ³ Savey 50DF or Onager 1EC	- -	4-8 fl oz 3-6 oz or 12-24 fl oz
Plum curculio (PC)	E = 5, 14, 15 G = 2, 3, 4	10. Esteem 35WP 11. ⁴ Agri-Mek, Abba, or Temprano 0.15EC	- 2.5-5 fl oz	5 oz 10-20 fl oz
Codling moth (CM)	E = 5, 15, 24, 25 G = 3, 4, 10, 14, 26	12. ⁵ Nexter 75WP 13. Provado or Pasada 1.6F	- 5 fl oz	4.4-10.7 oz 20 fl oz
Oriental fruit moth (OFM)	E = 5, 15, 16, 24, 25 G = 3, 4, 14	14. Avaunt 30WDG 15. Guthion 50W 16. CheckMate OFM-F 17. Acramite 50WS 18. Zeal 72WDG 19. Portal 5EC 20. Kanemite 15SC 21. Envidor 2SC 22. Clutch 50WDG 23. Beleaf 50SG 24. Delegate 25WG 25. Altacor 35WDG 26. Belt 4SC 27. Movento 2SC	- 8 oz - - - 10 fl oz - - - - - - - - -	5-6 oz 1.5-2.0 lb 1.3-2.9 fl oz 12-16 oz 2-3 oz 2 pt 31 fl oz 16-18 fl oz 3 oz 2-2.8 oz 6-7 oz 2.5-4.5 oz 3-5 fl oz 6-9 fl oz

¹ If PP is a problem, alternating sprays of Thionex or Imidan will improve control. If PP is not a problem, reduce insecticide rates for PP by 25%.

² Do not apply after petal fall.

³ Apply only once per season, when eggs or young mites are present.

⁴ See comments on p. 33.

⁵ Use higher rates for PP and TSM.

PEACHES AND NECTARINES

DORMANT SPRAY

Chemical effectiveness rating: E = excellent, G = good, F = fair

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Leaf curl ¹	E = 1,2,4,5,6 G = 3	1. Ferbam 76WDG	2-3 lb	-
		2. Liquid lime sulfur	4 gal	-
		3. ³ Copper sulfate (25%Cu) + hydrated lime	2 lb + 4 lb	-
		4. ² Bravo 720 (or equivalent a.i. of other formulation)	16-22 fl oz	3.1-4.1 pt
		5. ³ Basic Copper (50% Cu)	4.0 lb	-
		6. Ziram 76DF or WDG	2 lb	-

¹ CAUTION: Thorough coverage is essential for leaf curl control. Apply when there is little or no wind and use dilute sprays only. May be applied in the fall after 90% of the leaves have fallen or in the spring before the buds swell. If leaf curl has been severe or difficult to control, use the higher rate per 100 gal of dilute spray. In those peach and nectarine orchards where leaf curl was severe during the previous year, a fall and spring application of either of the above fungicides would be advisable until the leaf curl problem has been corrected. According to the label, both spring and fall applications of Bravo may be made for control of leaf curl. Thorough coverage of each bud is necessary for leaf curl control.

Do not combine liquid lime sulfur with oil.

² The above dilute rate for Bravo 720 is for 300 gal/A.

³ NOTE: Treatments with copper compounds are suggested where bacterial spot has been a problem.

DORMANT SPRAY¹ (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
San Jose Scale (SJS)	E = 1,1+2, 3	1. Superior oil	2 gal	—
Mite eggs (ERM)	E = 1	2. Lorsban 3.8E, Nufos 4E, Yuma 4E, or Lorsban 75WG	1 pt or 10 oz	—
		3. Esteem 35W	—	4-5 oz

¹ A dilute application is recommended for effective control.

94 Peaches and Nectarines

PINK SPRAY

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Brown rot blossom blight	E = 7, 8, 11, 12, 13 14, 15 G = 4, 9, 10	4. ¹ Bravo 720 (or equivalent a.i. of other formulation)	16-22 fl oz	3.1-4.1 pt
		7. ² Topsin-M 70W + Captan 50W	4-6 oz + 1-2 lb	12-18 oz + 3-4 lb
		8. ² Topsin-M 70W + Sulfur 95W	4-6 oz + 4-6 lb	12-18 oz + 12-15 lb
		9. Captan 50W	2 lb	5 lb
		10. Sulfur 95W	6 lb	15 lb
		11. Rovral 50W	-	2 lb
		12. Rally 40WSP	1.25-2.0 oz	2.5-6.0 oz
		13. Tilt 3.6E	-	4 fl oz
		14. Indar 2F	-	6 fl oz
		15. Elite 45DF	2 oz	5 oz

¹ NOTE: The above concentrate rate for Bravo 720 is for trees 20 ft. or shorter. For taller trees, use 4.1-5.5 pt/A.

² CAUTION: A strain of brown rot resistant to the benzimidazole fungicide Topsin-M is present in some areas of Virginia. To reduce the threat of resistance to Topsin-M, it should be used only in combination with other (non-benzimidazole) fungicides. If resistance is suspected, submit a brown rot sample to Virginia Tech AREC, Winchester, Virginia and switch to a different fungicide program until the fungus has been tested for sensitivity.

PINK SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Tarnished plant bug (TPB)	E = 1, 4, 5, 6, 7, 9, 11, 12 G = 2, 3, 8, 13, 14	1. Carzol 92SP	6 oz	1 lb
		2. Thionex 50WP or 3EC	1 lb or 21 fl oz	3 lb or 4 pt
Green peach aphid (GPA) ¹	E = 8, 13, 14 G = 2, 3	3. ² Lannate 90SP	4 oz	12 oz
		4. Asana XL or Adjourn 0.66EC	3 fl oz	8 fl oz
Oriental fruit moth (OFM)	E = 10	5. Ambush 25WP or Perm-UP 25WP	-	6.4-19.2 oz
		6. Pounce 3.2EC or Perm-UP 3.2EC	-	4-12 fl oz
		7. Warrior 1CS, Lambda-Cy 1EC, Silencer 1EC, or Warrior 2CS	-	2.6-5.1 fl oz or 1.3-2.5 fl oz
		8. ³ Actara 25WG	-	3.0-5.5 oz
		9. Proaxis 0.5CS	-	2.6-5.1 fl oz
		10. Isomate Rosso	not a spray	
		11. Baythroid XL 1EC or Tombstone 2EC	-	2.0-2.4 fl oz
		12. Mustang Max 0.8EC	-	1.3-4 fl oz
		13. Beleaf 50SG	-	2-2.8 oz
		14. ⁴ Assail 30SG	-	2.5-8 oz

¹ In most years, control of GPA is not required before petal fall; however, lower small (half inch) leaves should be checked carefully for the presence of immigrating adults or newly deposited nymphs. If GPA are found commence the aphid treatment.

² Available for nectarines by 24(c) label in Virginia and West Virginia.

³ Use 3-4 oz/A for GPA; 4.5-5.5 oz/A for TPB.

⁴ Use 2.5-5.3 oz/A for GPA; 5.3-8.0 oz/A for TPB.

BLOOM PERIOD SPRAY

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Brown rot blossom blight	E = 7, 8, 11, 12, 13, 14, 15, 19 G = 4, 9, 10	4. ¹ Bravo 720 (or equivalent a.i. of other formulations)	16-22 fl oz	3.1-4.1 pt
		7. ² Topsin-M 70W + Captan 50W	4-6 oz + 1-2 lb	12-16 oz + 3-4 lb
		8. ² Topsin-M 70W + Sulfur 95W	4-10 oz + 4-6 lb	12-32 oz + 12-15 lb
		9. Captan 50W	2 lb	5 lb
		10. Sulfur 95W	6 lb	15 lb
		11. Rovral 50W	-	2 lb
		12. Rally 40WSP	1.25-2.0 oz	2.5-6.0 oz
		13. Tilt 3.6E	-	4 fl oz
		14. Indar 2F	-	6 fl oz
		15. Elite 45DF	2 oz	5 oz
		19. Vanguard 75WG	-	5 oz

¹ NOTE: The above concentrate rate for Bravo 720 is for trees 20 ft or shorter. For taller trees, use 4.1-5.5 pt/A.

² See caution about Topsin-M under pink spray.

INSECTS: Do not apply insecticides during bloom.

PETAL FALL SPRAY

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Brown rot	E = 7, 8, 12, 13, 14, 15 G = 4, 9, 10	4. ¹ Bravo 720 (or equivalent a.i. of other formulation)	16-22 fl oz	3.1-4.1 pt
		7. ² Topsin-M 70W + Captan 50W	4-6 oz + 1-2 lb	12-18 oz + 3-4 lb
		8. ² Topsin-M 70W + Sulfur 95W	4-6 oz + 4-6 lb	12-18 oz + 12-15 lb
		9. Captan 50W	2 lb	5 lb
		10. Sulfur 95W	6 lb	15 lb
		12. Rally 40WSP	1.25-2.0 oz	2.5-6.0 oz
		13. Tilt 3.6E	-	4 fl oz
		14. Indar 2F	-	6 fl oz
		15. Elite 45DF	2.0 oz	5 oz

¹ NOTE: The above concentrate rate for Bravo 720 is for trees 20 ft or shorter. For taller trees use 4.1-5.5 pt/A.

² CAUTION: See caution about Topsin-M under pink spray. Do not apply Bravo 720 after shuck split stage. In nectarine plantings where scab has been destructive, apply four sprays at weekly intervals.

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PETAL FALL SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Tarnished plant bug (TPB)	E = 3, 4, 5, 6, 9, 10, 14	1. Thionex 50WP or 3EC	1 lb or 21 fl oz	3 lb or 4 pt
	G = 1, 2, 8, 11, 15, 19	2. ¹ Lannate 90SP	4 oz	12 oz
Stink bugs (SB)	E = 3, 4, 5, 6, 9, 10, 14	3. Asana XL or Adjourn 0.66EC	3 fl oz	8 fl oz
	G = 1, 2, 8, 11, 15, 19	4. Ambush 25WP or Perm-UP 25WP	-	6.4-19.2 oz
Green peach aphid (GPA)	E = 7, 8, 15, 18, 19	5. Pounce 3.2EC or Perm-UP 3.2EC	-	4-12 fl oz
	G = 1, 2	6. Warrior 1CS, Lambda-Cy 1EC, Silencer 1EC, or Warrior 2CS	-	2.6- 5.1 fl oz or 1.3-2.5 fl oz
Plum curculio (PC)	E = 8, 11, 16	7. Provado or Pasada 1.6F	2 fl oz	4- 8 fl oz
	G = 3, 4, 5, 6, 9, 10, 14	8. ³ Actara 25WG	-	3.0-5.5 oz
Western flower thrips (WFT) ²	E = 12, 13, 17 G = 2	9. Proaxis 0.5EC	-	2.6-5.1 fl oz
		10. Baythroid XL 1EC or Tombstone 2EC	-	2.4-2.8 fl oz
		11. Imidan 70WSB	12-16 oz	2-3 lb
		12. SpinTor 2SC	1-2 fl oz	4-8 fl oz
		13. Entrust 80WP	0.3- 0.6 oz	1.25- 2.5 oz
		14. Mustang Max 0.8EC	-	1.3-4 fl oz
		15. Beleaf 50SG	-	2-2.8 oz
		16. Avaunt 30WDG	-	5-6 oz
		17. Delegate 25WG	-	4.5-7 oz
		18. Movento 2SC	-	6-9 fl oz
19. ⁴ Assail 30SG	-	2.5-8 oz		

¹ Residual life of this material is short; extend effectiveness by combining with 1/2 rate of 15. 24(c) label for nectarines in Virginia and West Virginia.

² Control WFT now if scarring has been a problem.

³ Use 3.0-4.0 oz/A for GPA; 4.5-5.5 oz/A for PC, TPB, and SB.

⁴ Use 2.5-5.3 oz/A for GPA; 5.3-8.0 oz/A for TPB, SB, and PC.

SHUCK SPLIT, SHUCK FALL SPRAYS¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Scab	E = 18	4. Bravo 720	16-22 fl oz	3.1- 4.1 pt
	G = 7, 8, 9, 10, 14	7. Topsin-M 70W + Captan 50W	4-6 oz + 1-2 lb	12-18 oz + 3-4 lb
Brown rot	E = 7, 8, 14	8. Topsin-M 70W + Sulfur 95W	4-6 oz + 4-6 lb	12-18 oz + 12-15 lb
	G = 9, 10	9. Captan 50W	2 lb	5 lb
Rusty Spot	E = 12, 14 G = 8, 18 F = 7, 10	10. Sulfur 95W	6 lb	15 lb
		12. Rally 40WSP	1.25-2.0 oz	2.5-6.0 oz
		14. Indar 2F	-	6 fl oz
		18. Gem 25WG	-	4-8 oz

¹ CAUTION: Do not apply Bravo after shuck-split stage. Do not extend intervals between cover sprays more than 14 days. Where scab has been a serious problem, see petal fall spray for more effective combinations.

SHUCK SPLIT, SHUCK FALL SPRAYS¹ (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Tarnished plant bug (TPB)	G = 1, 2, 4, 5, 8, 13	1. Thionex 50WP or 3EC	1 lb or 21 fl oz	3 lb or 4 pt
		2. ² Lannate 90SP	4 oz	12 oz
Stink bugs (SB)	G = 1, 2, 4, 5, 8, 13	3. Provado or Pasada 1.6F	2 fl oz	4-8 fl oz
Green peach aphid (GPA)	E = 3, 4, 8, 12, 13 G = 1, 2	4. ⁴ Actara 25WG	-	3.0-5.5 oz
		5. Imidan 70WSB	16-21 oz	3-4 lb
Plum curculio (PC)	E = 4, 5, 9	6. ³ Isomate LPTB	not a spray	
Oriental fruit moth (OFM)	E = 2, 5, 10, 11 G = 7, 13	7. Intrepid 2F	-	12-16 fl oz
		8. Beleaf 50SG	-	2-2.8 oz
Lesser peachtree borer	E = 6	9. Avaunt 30WDG	-	5-6 oz
		10. Delegate 25WG	-	6-7 oz
		11. Altacor 35WDG	-	3-4.5 oz
		12. Movento 2SC	-	6-9 fl oz
		13. ⁵ Assail 30SG	-	2.5-8 oz

¹ CAUTION: Applications at both shuck split and shuck fall are important to prevent catfacing injury.

² Residual life of this material is short; extend effectiveness by combining with 1/2 rate of 15. 24(c) label for nectarines in Virginia and West Virginia.

³ Isomate pheromone dispensers for LPTB should be placed before first flight at 100/A. Be sure to read note on p. 37. Isomate LPTB is also effective against PTB when used at a higher rate (200-250/A).

⁴ Use 3.0-4.0 oz/A for GPA and 4.5-5.5 oz/A for PC, TPB, and SB.

⁵ Use 2.5-5.3 oz/A for GPA; 5.3-8.0 oz/A for TPB, SB, PC and OFM.

FIRST COVER SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Scab	E = 18 G = 7, 8, 9, 10, 14	7. Topsin-M 70W + Captan 50W	4-6 oz + 1-2 lb	12-18 oz + 3-4 lb
		8. Topsin-M 70W + Sulfur 95W	4-6 oz + 4-6 lb	12-18 oz + 12-15 lb
Brown rot	E = 7, 8, 14 G = 9, 10	9. Captan 50W	2 lb	5 lb
		10. Sulfur 95W	6 lb	15 lb
Rusty spot	E = 12, 14 G = 8, 18 F = 7, 10	12. Rally 40WSP	1.25-2.0 oz	2.5-6.0 oz
		14. Indar 2F	-	6 oz
		18. Gem 25WG	-	4-8 oz

¹ CAUTION: Do not extend intervals between cover sprays more than 14 days. Where scab has been a serious problem, see petal fall spray for more effective combinations. Do not apply Bravo after shuck-split stage.

FIRST COVER SPRAY (cont.)

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Tarnished plant bug (TPB)	E = 2, 3, 4, 5, 6, 7, 15 G = 1, 8, 17, 19	1. ¹ Lannate 90SP	4 oz	12 oz
Stink bugs (SB)	E = 2, 3, 4, 5, 6, 7, 15 G = 1, 8, 17, 19	2. Asana XL or Adjourn 066EC	3 fl oz	8 fl oz
Oriental fruit moth (OFM)	E = 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 15, 16, 18 G = 9, 12, 14, 19	3. Ambush 25WP or Perm-UP 25WP	-	6.4-19.2 oz
Periodical cicada (C) ²	E = 2, 3, 4, 5, 6, 7, 15 G = 1, 13, 14, 19	4. Pounce 3.2EC or Perm-UP 3.2EC	-	4-12 fl oz
Lesser peachtree borer adults (LPTB) ³	G = 2, 3, 4, 5, 6, 7, 15	5. Warrior 1CS, Lambda-Cy 1EC, Silencer 1EC, or Warrior 2CS	-	2.6-5.1 fl oz or 1.3-2.5 fl oz
		6. Proaxis 0.5CS	-	2.6-5.1 fl oz
		7. Baythroid XL 1EC Tombstone 2EC	-	2.4-2.8 fl oz
		8. Imidan 70WSB	16-21 oz	3-4 lb
		9. Intrepid 2F	-	12-16 fl oz
		10. ⁵ Isomate M100	not a spray	
		11. CheckMate OFM-F	-	1.3-2.9 fl oz
		12. ⁵ Disrupt OFM	not a spray	
		13. ⁴ Sevin XLR PLUS	2 pt	5 pt
		14. Sevin 50W	2 lb	5 lb
		15. Mustang Max 0.8EC	-	1.3-4 fl oz
		16. Delegate 25WG	-	6-7 oz
		17. Beleaf 50SG	-	2-2.8 oz
		18. Altacor 35WDG	-	3-4.5 oz
		19. Assail 30SG	-	5.3-8 oz

¹ Residual life of this material is short; extend effectiveness by combining with 1/2 rate of 15. For nectarines by 24(c) label in Virginia and West Virginia.

² Cicada immigration from unsprayed areas necessitates frequent applications for effective control. See maps, Fig. 2, for location and year of cicada occurrence.

³ Pyrethroids give good control of adults. Monitor with pheromone trap for proper timing. Mites can be expected to increase if pyrethroids are used at this time. Monitor them closely. If adults are not controlled now, other recommendations for larval control are given under second cover spray.

⁴ Sevin XLR PLUS is safer for honey bees, mainly when used in concentrate sprays of 25 gallons per acre (1:39 dilution ratio). However some additional bee safety over Sevin 50W is obtained when applied in more dilute sprays.

⁵ Mating disruption for OFM should be applied before first flight of second generation (Figure 3). Be sure to read note on p. 37.

SECOND COVER SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Scab	E = 18 G = 7, 8, 9, 10, 14	7. Topsin-M 70W + Captan 50W	4-6 oz + 1-2 lb	12-18 oz + 3-4 lb
Brown rot	E = 7, 8, 14 G = 9, 10	8. Topsin-M 70W + Sulfur 95W	4-6 oz + 4-6 lb	12-18 oz + 12-15 lb
Rusty spot	E = 12, 14 G = 8, 18 F = 7, 10	9. Captan 50W	2 lb	5 lb
		10. Sulfur 95W	6 lb	15 lb
		12. Rally 40WSP	1.25-2.0 oz	2.5-6.0 oz
		14. Indar 2F	-	6 fl oz
		18. Gem 25WG	-	4-8 oz

¹ CAUTION: Do not extend intervals between cover sprays more than 14 days. Where scab has been a serious problem, see petal fall spray for more effective combinations.

SECOND COVER SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Stink bugs (SB)	G = 1, 2, 3, 8	1. Thionex 50WP or 3EC	1.5 lb or 1 qt	-
Oriental fruit moth (OFM)	E = 2, 3, 5, 6, 7 G = 4, 8	2. ¹ Lannate 90SP	4 oz	12 oz
		3. Imidan 70WSB	16-21 oz	3-4 lb
Lesser peach tree borer larvae (LPTB) ²	G = 1	4. Intrepid 2F	-	12-16 fl oz
		5. CheckMate OFM-F	-	1.3-2.9 fl oz
		6. Delegate 25WG	-	6-7 oz
		7. Altacor 35WDG	-	3-4.5 oz
		8. Assail 30SG	-	5.3-8 oz

¹ Residual life of this material is short; extend effectiveness by combining with 1/2 rate of 15. Available for nectarines by 24(c) label in Virginia and West Virginia.

² A handgun application is recommended for LPTB larval control. Thoroughly cover all wounded bark areas on trunk, scaffold limbs, and small branches.

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THIRD COVER SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Brown rot ²	E = 7, 8, 14 G = 9, 10	7. Topsin-M 70W + Captan 50W	4-6 oz + 1-2 lb	12-18 oz + 3-4 lb
Rusty spot	E = 12, 14 G = 8 F = 7, 10	8. Topsin-M 70W + Sulfur 95W	4-6 oz + 4-6 lb	12-18 oz + 12-15 lb
		9. Captan 50W	2 lb	5 lb
		10. Sulfur 95W	6 lb	15 lb
		12. Rally 40WSP	1.25-2.0 oz	2.5-6.0 oz
		14. Indar 2F	-	6 fl oz

¹ Do not extend intervals between cover sprays more than 14 days.

² Fungicide applications for brown rot control are not required for green fruit after the pit-hardening stage. Resume fungicide applications as fruit begin to color or as weather favorable for brown rot development occurs.

THIRD COVER SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Stink bugs (SB)	G = 1, 2, 3, 14	1. Thionex 50WP or 3EC	1.5 lb or 1 qt	—
Oriental fruit moth (OFM)	E = 2, 3, 7, 12, 13 G = 6, 14	2. ¹ Lannate 90SP	4 oz	12 oz
		3. Imidan 70WSB	16-21 oz	3-4 lb
Lesser peach tree borer larvae (LPTB) ²	G = 1	4. SpinTor 2SC	1-2 fl oz	4-8 fl oz
		5. Entrust 80WP	0.3-0.6 oz	1.25- 2.5 oz
Peachtree borer (PTB)	E = 10	6. Intrepid 2F	-	12-16 fl oz
Leafrollers (RBLR,VLR,TBM)	E = 2, 4, 5, 6, 12, 13, 15 G = 3	7. CheckMate OFM-F	-	1.3-2.9 fl oz
		8. ³ Apollo 42SC	-	4-8 fl oz
Mites (ERM)	E = 8, 9 G = 11	9. ³ Savey 50DF or Onager 1EC	-	3-6 oz or 12-24 fl oz
		10. ⁴ Isomate-P	not a spray	
		11. Vendex 50W	6 oz	1 lb
		12. Delegate 25WG	-	6-7 oz
		13. Altacor 35WDG	-	3-4.5 oz
		14. Assail 30SG	-	5.3-8 oz
		15. Belt 4SC	-	3-5 fl oz

¹ Residual life of this material is short; extend effectiveness by combining with 1/2 rate of 15. Available for nectarines by 24(c) label in Virginia and West Virginia.

² If population is unusually heavy, apply second handgun spray for LPTB control 3 weeks after the first application.

³ Mites are less important on peach than apple. Apply at a time before mites are most damaging. These materials should best be considered in blocks where other acaricides have failed to give adequate control.

⁴ Isomate pheromone dispensers for PTB should be placed at 100/A before first flight. Be sure to read note on p. 37.

FOURTH AND FIFTH COVER SPRAYS¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Brown rot	E = 7, 8 G = 9, 10	7. Topsin-M 70W + Captan 50W	4-6 oz + 1-2 lb	12-18 oz + 3-4 lb
		8. Topsin-M 70W + Sulfur 95W	4-6 oz + 4-6 lb	12-18 oz + 12-15 lb
		9. Captan 50W	2 lb	5 lb
		10. Sulfur 95W	6 lb	15 lb

¹ Do not exceed 14-day intervals between cover sprays. Consult pre-harvest spray intervals (Table 25) for early-maturing cultivars.

FOURTH AND FIFTH COVER SPRAYS (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Stink bugs (SB)	G = 1, 2, 16	1. ¹ Lannate 90SP	4 oz	12 oz
Plum curculio (PC) ²	E = 2, 13	2. Imidan 70WSB	16-21 oz	3-4 lb
Western flower thrips (WFT)	E = 3, 4, 14 G = 1, 16	3. SpinTor 2SC	1-2 fl oz	4-8 fl oz
		4. Entrust 80W	0.3-0.6 oz	1.25- 2.5 oz
Oriental fruit moth (OFM)	E = 1, 2, 6, 14, 15 G = 5, 7, 8, 16	5. Intrepid 2F	-	12-16 fl oz
		6. CheckMate OFM-F	-	1.3-2.9 fl oz
Leafrollers (RBLR,VLR,TABM)	E = 1, 3, 4, 5, 14, 15, 17 G = 2	7. ³ Sevin XLR PLUS	2 pt	5 pt
		8. ³ Sevin 50W	2 lb	5 lb
Japanese beetle (JB)	E = 7, 8 G = 1, 16	9. Vendex 50W	6 oz	1 lb
		10. ⁴ Nexter 75WP	-	4.4-10.7 oz
Cicada (C) ²	G = 1, 7, 8, 16	11. Acramite 50WS	-	12-16 oz
		12. Envirdor 2SC	-	16-18 fl oz
Mites (ERM,TSM)	E = 10, 11, 12 G = 9	13. Avaunt 30WDG	-	5-6 oz
		14. Delegate 25WG	-	6-7 oz
		15. Altacor 35WDG	-	3-4.5 oz
		16. Assail 30SG	-	5.3-8 oz
		17. Belt 4SC	-	3-5 fl oz

¹ Residual life of this material is short; extend effectiveness by combining with 1/2 rate of 15. Available for nectarines by 24(c) label in Virginia and West Virginia.

² PC and C require control in limited areas. Consult the spray-to-harvest interval when selecting chemicals for application.

³ Sevin application is likely to result in an increase in mites. Eliminate blooming weeds in order to protect bees. See note on Sevin XLR PLUS on p. 68.

⁴ Use the higher rate range for TSM.

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PRE-HARVEST SPRAYS¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Brown rot	E = 7, 8, 13, 14, 15, 17 G = 9, 16	7. Topsin-M 70W + Captan 50W	4-6 oz 1-2 lb	12-18 oz + 3-4 lb
Rhizopus rot		8. Topsin-M 70W + Sulfur 95W	4-6 oz + 4-6 lb	12-18 oz + 12-15 lb
		9. ² Captan 50W	2 lb	5 lb
		13. ³ Tilt 3.6E	-	4 fl oz
		14. ⁴ Indar 2F	-	6 fl oz
		15. ⁵ Elite 45DF	2.0 oz	5 oz
		16. Elevate 50WDG	-	1.0-1.5 lb
		17. ⁶ Pristine 38 WDG	-	10.5- 14.5 oz

¹ Starting two to three weeks before harvest, shorten the spray interval to 7-10 days. Where a range of rates is presented, use the higher rates under heavier disease pressure (rot present or rainy, humid weather).

² IF FRUIT IS TO BE SHIPPED TO CANADA, DO NOT APPLY CAPTAN CLOSER TO HARVEST THAN 2 DAYS. The residue tolerance for Captan in Canada is 5 ppm.

³ Do not exceed two applications of Tilt in the pre-harvest period.

⁴ Do not apply more than 48 fl oz per acre per year of Indar 2F.

⁵ Do not apply more than 3 lb of Elite per acre per year.

⁶ Do not make more than two sequential applications of Pristine before alternating to a fungicide with another mode of action.

HARVESTED FRUIT TREATMENT¹

Diseases	Fungicide	Rate per 100 Gal
Brown rot	Scholar 50W	8-16 oz (see label for specific information on application methods, mixtures, etc.)
Rhizopus rot		

¹ Do not make more than one post-harvest application to the fruit by any application method.

CAUTION: Flush and clean the hydrocooler daily. With the losses of postharvest uses of Benlate, Topsin-M and Botran, there is increased interest in the use of chlorine as a postharvest hydrocooler treatment for stone fruits. The main value of chlorine is to kill viable spores of brown rot and other fungi to reduce the likelihood of serious infection in the hydrocooler water. Although chlorine kills fungal spores in the hydrocooler, it provides no residual fungicidal activity. Several registered chlorine-generating materials are available as calcium hypochlorite or sodium hypochlorite. Use only products which are registered for the desired use and use according to the label. Carefully monitor the concentration and maintain a "dirt-free" hydrocooler because chlorine is quickly de-activated by particulate matter. Because chlorine is pH sensitive, water must be monitored frequently and adjusted to neutral pH. Even with these factors controlled, chlorine lacks residual activity for protecting bruised fruit.

As with any new practice or product, caution is advised. Some possible drawbacks to chlorine use are: 1) it is corrosive to metal, 2) it is sensitive to pH (monitor water pH and chlorine concentration regularly), 3) chlorine concentration must be recharged frequently, and 4) although it is effective for killing fungal spores in water, it does not protect wounded tissue against subsequent infection from spores lodged in the wound.

POST HARVEST BORER SPRAY¹

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Peachtree borer (PTB)	E = 2 G = 1	1. Thionex 50WP or 3EC	1.5 lb or 1 qt	-
Lesser peachtree borer (LPTB)	E = 2 G = 1	2. Lorsban 3.8E, Nufos 4E, Yuma 4E, or Lorsban 75WG	3 qt or 4 lb	-

¹ A handgun application is recommended. See note (2), p. 100, and section on mating disruption, p. 37.

FALL PRE-DORMANT SPRAY

Treatments with copper compounds are suggested where bacterial spot has been a problem. Apply at early leaf drop to protect the leaf abscission scars from fall infection and subsequent overwintering twig infection. Use label rate of copper material. A copper material applied in the fall is usually also adequate for leaf-curl control.

FIGURE 3. PEACH INSECT LIFE CYCLES

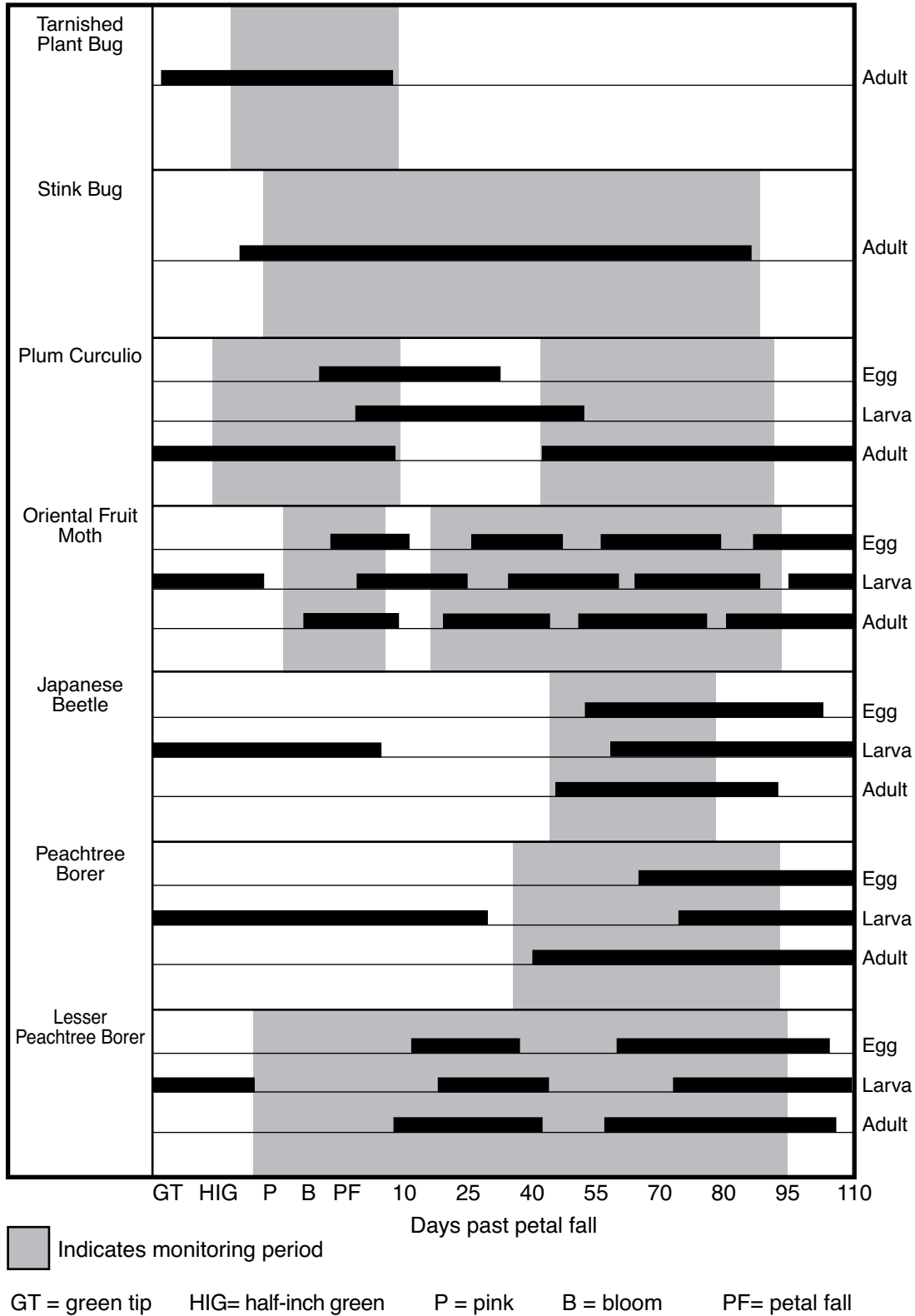


Table 12. Seasonal Activity of Peach Diseases

	Infection periods (*): observable symptoms (S)										
	Cytospora canker		brown rot			scab		rusty spot and powdery mildew			bacterial spot
	new	old	leaf curl	blossoms & twigs	fruit	fruit	shoots	rusty spot and powdery mildew	Rhizopus rot	bacterial spot	
dormant	*							S			
bud swell	* S		*					S			
pink	* S		*	*							
bloom	* S			* S							*
petal fall	* S		S	* S	*		*	*			*
shuck split	S		S	S	*		*	*			*
1st-3rd covers	S		S	S	*		*	* S			* S
4th-6th covers	S					* S		S			* S
preharvest						* S		S			S
harvest						* S		S	*		S
after harvest	*					* S		S	* S		S
fall	*						S				*

Note: Date for development of diseases may vary by several weeks from year to year.

Supplementary Peach Disease Discussions

PEACH CANKER

Peach canker, also called *Cytospora* canker, perennial canker, or *Valsa* canker, is found primarily on peach and nectarine, although the causal fungus can also be found in cankers and twig dieback on plum, prune, sweet and sour cherry, wild black cherry and choke cherry, and apple. The fungus which causes peach canker enters the plant only through wounds or injuries. Practices which reduce the occurrence of injuries help reduce the frequency and severity of infection. All attempts to control peach canker must take place within the framework of an integrated crop management strategy. Managing the disease should be considered in all phases of orchard management from the establishment of new plantings to the care of bearing orchards. The present strategy of canker control is based on preventive measures designed to decrease winter injury and insect damage, to promote optimum plant health, and to facilitate rapid wound healing. As with other diseases, once canker becomes established within an orchard, it becomes increasingly difficult to control new infections. The following practices aid greatly in the prevention of peach canker:

- 1) Proper site selection. The site for the new orchard should have deep, well-drained soil and good air drainage to minimize the chances for winter injury. New plantings should be reasonably well-isolated from sources of disease inoculum. Young trees should not be planted adjacent to older, heavily infected blocks, and the downwind side of older blocks should be avoided. Interplanting young trees among older, diseased trees may appear economical, but the young trees planted in this way are at a much greater risk for developing cankers and having a shorter productive life than young trees planted in solid blocks.
- 2) Selection of cultivar and nursery stock. No commercial cultivar is resistant to peach canker. Only the hardier cultivars should be planted. Nursery stock should be disease free. Trees with small cankers on lateral branches may be planted if they are pruned so that at least 6 inches of healthy tissue below the canker is removed. Examine all trees closely and return the ones with obvious cankers to the nursery. Transplanting stress weakens trees and increases their susceptibility to disease. Trees should be carefully inspected after growth begins, and dead branches removed. Plant trees as soon as possible after receiving them from the nursery to avoid any additional stress. Avoid stock that is excessively large (greater than 11/16 inch) because the transplanting stress takes longer to overcome compared to smaller trees.
- 3) Orchard care. Many aspects of orchard care interact to form an integrated management system. For optimum control of peach canker, all the practices listed below should be followed:
 - a) Nematode, insect, and disease control. Do not establish new trees in soils with high populations of plant pathogenic nematodes. Control oriental fruit moth and peach tree borers, even in the first few nonbearing years. Control brown rot to prevent twig infections which are often colonized by *Cytospora* spp.
 - b) Train trees properly. Trees must be trained carefully during the first season so that branches develop wide crotch angles. Wide crotch angles are necessary for long orchard life. Narrow crotch angles are more susceptible to winter injury, borer attack, and breakage under heavy crop loads.
 - c) Avoid rodent injury. Prevent rabbit and vole damage with plastic or wire guards. The guards should not be so high as to injure scaffold limbs when the tree sways in the wind. Plastic wrap-around guards should be removed each summer because they may delay hardening of the wood in late fall, they may harbor insects and interfere with trunk sprays for borer control. White latex paint mixed with Thiram also discourages rodent feeding and southwest injury.
 - d) Prevent cold injury. Low-temperature injury is always a potential problem in our area. Certain cultural practices delay tissue maturation and thus promote increased susceptibility to early fall cold injury. Practices such as over-fertilization with nitrogen or late application of nitrogen fertilizer should be avoided. Trickle irrigation to maintain tree growth and fruit size also has the added benefit of making trees more resistant to *Cytospora* canker. Avoid postharvest water deficits but don't irrigate beyond September 1.
 - e) Prune correctly and at the proper time. Infection at pruning cuts is less frequent when pruning is delayed until spring. Delay pruning until the first forecasts of warm, dry weather. Pruning should be well planned each year so that large cuts, which heal more slowly, will not be needed. When pruning side branches from larger limbs, the cut should be made just beyond the ridge of thickened bark where the smaller branch joins the larger limb. The branch bark ridge should not be removed or injured because it is the region where the most rapid and effective healing occurs. Avoid leaving stubs. Prune to open the center of the tree to light penetration because shaded branches are weakened and more susceptible to injury and infection. Remove all weakened and dead wood.
 - f) Canker surgery. Cankers should be removed from the tree and burned, buried, or moved out of the orchard. Cankers on trunks and large limbs can be surgically removed in June or July when trees heal most rapidly. Surgery should be performed in dry weather with a forecast of dry conditions for at least three days. During surgery, remove all diseased bark around the canker and about 1-2 inches of healthy tissue from the sides and ends, respectively. The

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resulting wound when finished should have a smooth margin and be slightly rounded above and below to favor rapid wound closure.

- g) Tree wound paints or sealers. There is conflicting information regarding the use and effectiveness of these materials. They are mostly cosmetic and, unless mixed with fungicide, do not act directly to prevent infection by *Cytospora* spp. or decay-causing fungi. The drying of tissue is a normal part of wound healing. Some materials actually seal in moisture, thus providing an ideal environment for fungal infection. Sites of surgery in June or July heal best if left uncovered. If tree paints must be used, they should be free of acrylic resins because some of these compounds may injure plant tissue.
- h) Chemical control. Chemical control of the peach canker fungus is difficult. Fungicides applied for the control of leaf curl and brown rot blossom blight may provide some protection of fresh pruning cuts against infection by *Cytospora*.
- i) Tree fertilization. Nitrogen fertilizer, if needed, should be applied in late winter or early spring to avoid inducing late, cold-susceptible growth in the fall. Don't fertilize excessively. Foliage should show a healthy green color and terminal growth should be about 12 inches on bearing trees and 18 to 24 inches on nonbearing trees. Trees with pale, nitrogen-deficient leaves are also more susceptible to infection. Balance nitrogen with an adequate supply of potassium. Use leaf analysis to determine fertilizer requirements.

BROWN ROT

All stone fruit cultivars are susceptible to this fungal disease and, in some seasons, crop losses may be extensive. The brown rot fungus causes blossom blight, shoot dieback, twig cankers, and fruit rot. Infected blossoms wilt, shrivel, and die. As they turn brown, they often become affixed to the twig in a gummy mass and in wet weather, become covered with grayish-tan tufts of fungal spores.

Cankers form in either spring or fall depending upon whether the fungus entered the twig through an infected blossom or fruit. The canker appears as a brownish, sunken area, often covered with gum. In wet weather the canker supports tufts of spores similar to infected blossoms. Usually the tree is able to restrict twig cankers to small oval areas at the junction of the twig and the infected blossom or fruit. However, it is not uncommon for the fungus to girdle the twig and cause death to the shoot beyond the canker. Leaves on such twigs wilt, turn brown, and remain attached for 2 to 3 weeks or longer.

The first evidence of fruit rot is the appearance of a small, circular, brown spot on the ripening fruit. The spot increases rapidly in size and within a week, the entire fruit is infected. The infection produces a soft rot, though the skin occasionally remains firm. The surface of the fruit soon becomes covered with grayish-tan powdery spore masses. The infected fruit may hang in the tree or drop to the ground. Finally, the fruit shrivels and becomes a hard, grayish-black mummy that may drop or remain in the tree over winter.

The fungus survives over the winter in two ways: 1) in the mummified fruit hanging in the tree or on the ground beneath the tree; and 2) in the twig cankers resulting primarily from the previous season's rotted fruit. Two types of spores are produced in the spring. The more important of the two spore types (conidia) is produced on the surface of cankers, blighted twigs, and mummified fruit within the tree. The second spore type (ascospores), which is rare in our region, forms in small brownish cup-shaped structures about the size of a dime, called apothecia. Both spore types cause blossom infection and spores from infected blossoms may contribute to infections of ripening fruit later in the year.

Where blossom infection is carefully controlled, growers may find they still have a brown rot problem on their ripening fruit. Cultivar characteristics and orchard management practices influence the carryover of brown rot spores from spring to fruit maturity. Certain cultivars produce a proportion of stunted fruit which may shrivel and continue to hang within the tree. All the major cultivars examined to date produce some stunted or aborted fruit, and such fruit often become infected and produce spores throughout the summer. Winter injury to fruit buds also may result in the formation of nonabscised, aborted fruit.

Improper timing of fruit thinning can influence levels of carryover inoculum. For example, fruit thinned later than the pit hardening stage of development is susceptible to infection on the orchard floor; whereas fruit thinned earlier decomposes without becoming infected.

Sanitation is essential if your orchard is to be considered at low risk for a brown rot epidemic. Following the practices listed below should minimize spore populations of brown rot and limit the likelihood of an epidemic when conditions are favorable for rapid disease development.

- 1) Remove all remaining fruit from the tree after the final picking. This practice limits infection of fruit peduncles and twigs, thus reducing the number of brown rot cankers. In addition, this practice prevents overwintering mummies in the canopy, where they would be adjacent to susceptible blossoms in the spring.

- 2) Thin all cultivars prior to the pit-hardening stage of fruit development. Fruit thinned after pit hardening may serve as a source of brown rot later in the season. A fungicide cover spray, with one nozzle directed at the orchard floor, may help limit the production of spores from thinned fruits.
- 3) In spring, survey the orchard for blossom infection and prune out any cankers and infected shoots.
- 4) In spring, during the blossom period, examine the orchard floor for apothecia, the cup-shaped fungal structures that produce ascospores. Their presence should be considered a potential plant disease emergency. Blossoms should be thoroughly protected with fungicide sprays throughout the bloom period if apothecia are present.
- 5) Prune to avoid overcrowding of branches thereby increasing air circulation, promoting rapid drying, and increasing light and spray penetration.
- 6) Avoid dumping rotten fruit in one location, which could become the starting point for disease and insect outbreaks in the following season.

Fungicides are recommended generally in a protective program and are applied to blossoms and fruit prior to fungal infection. Infections of ripe peach fruit may take place within 6 hours during rainy periods at 77° F.

BACTERIAL SPOT

Bacterial spot causes severe defoliation and fruit spotting on susceptible peach, nectarine, prune, and plum varieties. The bacteria infect leaves, fruit, and young succulent shoots. The leaf lesions are small, angular, and often appear as brown to black spots. If the center of the lesion drops out, the margin of the lesion may have a reddish coloration. The disease is often worse at the tip of the leaf. Infected leaves usually turn yellow and drop prematurely, resulting in reduced fruit size in severe cases. Fruit infection early in the growing season may appear as deep pits or cracks. Late-season infections are more superficial and give the fruit a slightly checked or mottled appearance. Twig infections may result in small cankers.

The bacterial pathogen overwinters in cankers which are initiated in the fall at leaf scars. As cankers develop in the following spring, the bacteria ooze and are then spread by windblown rain to young leaves, fruit, or shoots. Periods of frequent rainfall with moderate temperatures and high winds favor infection. Extended periods of hot, dry weather reduce the threat of this disease.

Use of resistant varieties is the primary control method for bacterial spot. Where bacterial spot is a problem, copper materials should be applied at leaf drop to protect the leaf abscission scars from fall infection and subsequent overwintering twig cankers. Copper materials applied in the fall are usually adequate for leaf-curl control. Spray programs with oxytetracycline (Mycoshield, Flameout) may help suppress development of disease, although they do not eliminate it. Because of the cost and uncertainty of chemical control, resistant varieties are the best control option. Relative susceptibility of some peach cultivars is as follows: highly susceptible - Blake, Jerseyland, Suncrest, Suncling, Sunhigh, Jersey Queen; moderately susceptible - J. H. Hale, Babygold 5, Kalhaven, Rio-Oso-Gem; relatively resistant - Redskin, Redhaven, Loring, Candor, Biscoe, Dixired, Sunhaven, Jefferson, Madison.

PLUMS AND PRUNES

Chemical effectiveness rating: E = excellent, G = good, F = fair

PREBLOOM SPRAYS

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Black knot	E = 1	1. Topsin-M 70W + F = 2	4-6 oz + Captan 50W	10-12 oz + 1-2 lb 3-6 lb
Brown rot	E = 1 G = 2	2. Captan 50W	2 lb	4.5 lb

CAUTION: To reduce potential for development of thiophanate-methyl-resistant strains of brown rot and other fungi, these fungicides are recommended only in combination with captan or other fungicides with different modes of action. To achieve successful black knot control, all knots must be cut out of the tree and removed from the orchard or burned before the start of the growing season. Captan may cause injury on Japanese-type and Stanley plums in early season.

PREBLOOM SPRAYS (cont.)¹

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
San Jose scale (SJS)	E = 1,1+2	1. Superior oil	2 gal	6 gal
Mite eggs (ERM)	E = 1	2. Lorsban 3.5E, Nufos 4E, Yuma 4E, Lorsban 75WG 3. Esteem 35W	1 pt or 10 oz -	2.5 pt or 2 lb 4-5 oz

¹ Control insects during the dormant or delayed-dormant period.

BLOOM SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Black knot	E = 1 F = 2	1. Topsin-M 70W + Captan 50W	4-6 oz + 1-2 lb	10-12 oz + 3-6 lb
Brown rot	E = 1 G = 2	2. Captan 50W	2 lb	4.5 lb

¹ CAUTION: Captan may cause injury on Japanese-type and Stanley plums in early season.

DO NOT APPLY INSECTICIDES DURING BLOOM

PETAL FALL SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Black knot	E = 1 F = 2	1. Topsin-M 70W + Captan 50W	4-6 oz + 1-2 lb	10-12 oz + 3-6 lb
Brown rot	E = 1 G = 2	2. Captan 50W	2 lb	4.5 lb

¹ CAUTION: Captan may cause injury on Japanese-type and Stanley plums in early season.

PETAL FALL SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Plum curculio (PC)	E = 2, 7	1. Actara 25WG	-	4.5-5.5 oz
	G = 1	2. Imidan 70WSB	12-16 oz	2-3 lb
Mites (ERM/TSM)	E = 4, 5, 6 G = 3	3. Vendex 50W	6 oz	1 lb
		4. Acramite 50WS	-	12-16 oz
		5. ¹ Nexter 75WP	-	4.4- 10.7 oz
		6. Envior 2SC	-	16-18 fl oz
		7. Avaunt 30WDG	-	5-6 oz

¹ Use higher rate for TSM.

SHUCK SPLIT, SHUCK FALL SPRAYS

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Black knot	E = 1	1. Topsin-M 70W + Captan 50W	4-6 oz +	10-12 oz +
	F = 2		1-2 lb	3-6 lb
Brown rot	E = 1 G = 2	2. ¹ Captan 50W	2 lb	4.5 lb

¹ CAUTION: Captan may cause injury on Japanese-type and Stanley plums in early season.

SHUCK SPLIT, SHUCK FALL SPRAYS (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Plum curculio (PC)	E = 2, 7	1. Actara 25WG	-	4.5-5.5 oz
	G = 1	2. Imidan 70WSB	12-16 oz	2-3 lb
Mites (ERM/TSM)	E = 4, 5, 6 G = 3	3. Vendex 50W	6 oz	1 lb
		4. Acramite 50WS	-	12-16 oz
		5. ¹ Nexter 75WP	-	4.4- 10.7 oz
		6. Envior 2SC	-	16-18 fl oz
		7. Avaunt 30WDG	-	5-6 oz

¹ Use higher rate for TSM.

FIRST COVER SPRAY

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Black knot	E = 1	1. Topsin-M 70W + Captan 50W	4-6 oz +	10-12 oz +
	F = 2		1-2 lb	3-6 lb
Brown rot	E = 1 G = 2	2. Captan 50W	2 lb	4.5 lb

FIRST COVER SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Plum curculio (PC)	E = 2, 7 G = 1	1. Actara 25WG	-	4.5-5.5 oz
		2. Imidan 70WSB	12-16 oz	2-3 lb
Mites (ERM/TSM)	E = 4, 5, 6 G = 3	3. Vendex 50W	6 oz	1 lb
		4. Acramite 50WS	-	12-16 oz
		5. ¹ Nexter 75WP	-	4.4- 10.7 oz
		6. Envidor 2SC	-	16-18 fl oz
		7. Avaunt 30WDG	-	5-6 oz

¹ Use higher rate for TSM.

SECOND AND THIRD COVER SPRAYS¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Black knot	E = 1 F = 2	1. Topsin-M 70W + Captan 50W	4-6 oz + 1-2 lb	10-12 oz + 3-6 lb
		2. Captan 50W	2 lb	4.5 lb
Brown rot	E = 3, 4, 5 G = 2	3. Tilt ²	-	4 fl oz
		4. ³ Pristine 38WDG	-	10.5- 14.5 oz
		5. Indar 2F	-	6 fl oz

¹ Additional sprays may be required during harvest if brown rot is prevalent or the harvest period is prolonged.

² Tilt is not to be used on plums to be dried and prepared as prunes.

³ Do not make more than two sequential applications of Pristine before alternating to a fungicide with another mode of action.

SECOND AND THIRD COVER SPRAYS (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Japanese beetle (JB)	E = 5, 6 G = 7	1. Vendex 50W	6 oz	1 lb
		2. Acramite 50WS	-	12-16 oz
Cicada (C) ¹	G = 5, 6, 7	3. ³ Nexter 75WP	-	4.4- 10.7 oz
Mites (ERM/TSM)	E = 2, 3, 4 G = 1	4. Envidor 2SC	-	16-18 fl oz
		5. Sevin 50W	2 lb	5 lb
		6. ² Sevin XLR PLUS	2 pt	5 pt
		7. Assail 30SG	-	5.3-8 oz

¹ See maps, Fig. 2, for location and year of cicada occurrence.

² See note (2) on Sevin XLR PLUS on p. 68.

³ Use higher rate for TSM.

CHERRIES (SWEET AND SOUR)

Chemical effectiveness rating: E = excellent, G = good, F = fair

PREBLOOM SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Brown rot blossom blight	E = 1, 4 G = 2, 3	1. Topsin-M 70W + Captan 50W	6-8 oz + 1-2 lb	18-24 oz + 3-6 lb
Black knot	E = 1 F = 2	2. Captan 50W 3. Bravo 720 (or equivalent a.i. of other formulation) 4. Indar 2F	2 lb 1-1.3 pt -	5 lb 3.1-5.5 pt 6 fl oz

¹ CAUTION: To reduce the potential for development of thiophanate-methyl resistant strains of brown rot and other fungi, these fungicides are recommended only in combination with captan or other fungicides with different modes of action.

INSECTS: No insects require control at this time.

PETAL FALL SPRAY

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Leaf spot	E = 1, 3, 4, 5, 6 G = 2	1. Topsin-M 70W + Captan 50W	6-8 oz + 1-2 lb	18-24 oz + 3-6 lb
Mildew	E = 5 G = 1, 6	2. Captan 50W	2 lb	5 lb
Black knot	E = 1	3. ¹ Bravo 720 (or equivalent a.i. of other formulation)	1-1.3 pt	3.1-5.5 pt
Brown rot	E = 1, 4, 5 G = 2, 3	4. Indar 2F 5. Rally 40WSP 6. Rubigan 1E	- 1.25-2.0 oz 3 fl oz	6 fl oz 2.5-6.0 oz 6 fl oz

¹ Do not apply Bravo between shuck-split and harvest.

PETAL FALL SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Plum curculio (PC)	E = 1, 2, 9 G = 7	1. Guthion 50W	8 oz	20 oz
Black cherry aphid (BCA)	E = 3, 6, 7, 10, 12, 13	2. ¹ Imidan 70WSB 3. Thionex 50WP or 3EC	12-16 oz 1 lb or 21 fl oz	2-3 lb 3 lb or 4 pt
Mites (ERM/TSM)	E = 5, 8, 11, 14 G = 4	4. Vendex 50W 5. ² Nexter 75WP 6. Provado or Pasada 1.6F 7. ³ Actara 25WG 8. Envidor 2SC 9. Avaunt 30WDG 10. Beleaf 50SG 11. Acramite 50WS 12. Movento 2SC 13. Assail 30SG 14. Zeal 72DG	6 oz - 2 fl oz - - - - - - - -	1 lb 4.4-10.7 oz 4-8 fl oz 3.0-5.5 oz 16-18 fl oz 5-6 oz 2-2.8 oz 12-16 oz 6-9 fl oz 2.5-5.3 oz 2-3 oz

¹ Do not apply Imidan on sweet cherries.

² Use higher rate for TSM.

³ Use 3.0-4.0 oz/A for BCA; 4.5-5.5 oz/A for PC.

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SHUCK FALL SPRAY

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Leaf spot	E = 1, 4, 5, 6 G = 2	1. Topsin-M 70W + Captan 50W	6-8 oz + 1-2 lb	18-24 oz + 3-6 lb
Mildew	E = 5 G = 1, 6	2. Captan 50W	2 lb	5 lb
Black knot	E = 1 F = 2	4. Indar 2F	—	6 fl oz
Brown rot	E = 1, 4, 5 G = 2	5. Rally 40WSP	1.25-2.0 oz	2.5-6.0 oz
		6. Rubigan 1E	3 fl oz	6 fl oz

SHUCK FALL SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Plum curculio (PC)	E = 1,2, 9 G = 7	1. Guthion 50W	8 oz	20 oz
Black cherry aphid (BCA)	E = 3, 6, 7, 10, 12, 13	2. ¹ Imidan 70WSB	12-16 oz	2-3 lb
Mites (ERM/TSM)	E = 5, 8, 11, 14 G = 4	3. Thionex 50WP or 3EC	1 lb or 21 fl oz	3 lb or 4 pt
		4. Vendex 50W	6 oz	1 lb
		5. ² Nexter 75WP	-	4.4-10.7 oz
		6. Provado or Pasada 1.6F	2 fl oz	4-8 fl oz
		7. ³ Actara 25WG	-	3.0-5.5 oz
		8. Envidor 2SC	-	16-18 fl oz
		9. Avaunt 30WDG	-	5-6 oz
		10. Beleaf 50SG	-	2-2.8 oz
		11. Acramite 50WS	-	12-16 oz
		12. Movento 2SC	-	6-9 fl oz
		13. Assail 30SG	-	2.5-5.3 oz
		14. Zeal 72WDG	-	2-3 oz

¹ Do not apply Imidan on sweet cherries.

² Use higher rate for TSM.

³ Use 3.0-4.0 oz/A for BCA; 4.5-5.5 oz/A for PC.

FIRST COVER SPRAY

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Leaf spot	E = 1, 4, 5, 6 G = 2	1. Topsin-M 70W + Captan 50W	6-8 oz + 1-2 lb	18-24 oz + 3-6 lb
Mildew	E = 5 G = 1, 6	2. ¹ Captan 50W	2 lb	5 lb
Black knot	E = 1 F = 2	4. Indar 2F	—	6 fl oz
Brown rot	E = 1, 4, 5 G = 2	5. Rally 40WSP	1.25-2.0 oz	2.5-6.0 oz
		6. Rubigan 1E	3 fl oz	6 fl oz

¹ CAUTION: Some sweet cherry cultivars such as Schmidt, Emperor Francis, and Giant may be sensitive to Captan.

FIRST COVER SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Plum curculio (PC)	E = 1, 2, 11	1. Guthion 50W	8 oz	20 oz
	G = 7	2. ¹ Imidan 70WSB	12-16 oz	2-3 lb
Black cherry aphid (BCA)	E = 3, 6, 7, 12, 14, 15	3. Thionex 50WP or 3EC	1 lb or 21 fl oz	3 lb or 4 pt
Mites (ERM/TSM)	E = 5, 8, 9, 10, 13, 16 G = 4	4. Vendex 50W	6 oz	1 lb
		5. ² Nexter 75WP	-	4.4-10.7 oz
		6. Provado or Pasada 1.6F	2 fl oz	4-8 fl oz
		7. ³ Actara 25WG	-	3.0-5.5 oz
		8. Envidor 2SC	-	16-18 fl oz
		9. Apollo 42SC	-	4-8 fl oz
		10. Savey 50DF or Onager 1EC	-	3-6 oz or 12-24 fl oz
		11. Avaunt 30WDG	-	5-6 oz
		12. Beleaf 50SG	-	2-2.8 oz
		13. Acramite 50WS	-	12-16 oz
		14. Movento 2SC	-	6-9 fl oz
		15. Assail 30SG	-	2.5-5.3 oz
		16. Zeal 72WDG	-	2-3 oz

¹ Do not apply Imidan on sweet cherries.

² Use higher rate for TSM.

³ Use 3.0-4.0 oz/A for BCA; 4.5-5.5 oz/A for PC.

SECOND COVER SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Leaf spot	E = 1, 4, 5, 6	1. Topsin-M 70W+	6-8 oz +	18-24 oz +
	G = 2	Captan 50W	1-2 lb	3-6 lb
Mildew	E = 5	2. ¹ Captan 50W	2 lb	5 lb
	G = 1, 6	4. Indar 2F	—	6 fl oz
Black knot	E = 1	5. ² Rally 40WSP	1.25-2.0 oz	2.5-6.0 oz
	F = 2	6. Rubigan 1E	3 fl oz	6 fl oz
Brown rot	E = 1, 4, 5			
	G = 2			

¹ CAUTION: Some cultivars such as Schmidt, Emperor Francis and Giant may be sensitive to Captan.

² DO NOT APPLY RALLY WITHIN 7 DAYS OF HARVEST and NO MORE THAN 3.25 lb per acre per season. Rubigan may be applied up to and after harvest but no more than 36 fl oz per acre prior to harvest. Do not apply more than 48 fl oz of Indar 2F per acre per year.

SECOND COVER SPRAY (cont.)

Insects/Mites	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Cherry fruit flies (CFF)	E = 1, 2	1. Guthion 50W	8 oz	20 oz
	G = 6, 7, 9, 10, 12, 13	2. ² Imidan 70WSB	12-16 oz	2-3 lb
Japanese beetle (JB)	E = 9, 10	4. Vendex 50W	6 oz	1 lb
	G = 13	5. ⁴ Nexter 75WP	-	4.4- 10.7 oz
Cicada (C) ¹	G = 9, 10, 13	6. Provado or Pasada 1.6F	2 fl oz	4-8 fl oz
		7. Actara 25WG	-	4.5-5.5 oz
Mites (ERM/TSM)	E = 5, 8, 11, 14 G = 4	8. Envidor 2SC	-	16-18 fl oz
		9. Sevin 50W	2 lb	5 lb
		10. ³ Sevin XLR PLUS	2 pt	5 pt
		11. Acramite 50WS	-	12-16 oz
		12. Delegate 25WG	-	4.5-7 oz
		13. Assail 30SG	-	5.3-8 oz
		14. Zeal 72WDG	-	2-3 oz

¹ See maps (Fig. 2) for location and year of cicada occurrence.

² Do not apply Imidan on sweet cherries.

³ See note 2 on Sevin XLR PLUS on p. 68.

⁴ Use higher rate for TSM.

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PREHARVEST SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Leaf spot	E = 1 G = 2	1. Topsin-M 70W+ Captan 50W	6-8 oz + 1-2 lb	18-24 oz + 3-6 lb
Brown rot	E = 1, 4 G = 2, 7	2. Captan 50W 4. Indar 75WSB	2 lb -	5 lb 2 oz
Alternaria rot	G = 2	7. Elevate 50WDG 8. ² Pristine 38WDG	- -	1.0- 1.5 lb 10.5- 14.5 oz

¹ CAUTION: DO NOT APPLY TOPSIN-M WITHIN ONE DAY OF HARVEST. Apply additional sprays during harvest if necessary to provide protection against fruit rots where the harvest is prolonged or the trees are mixed cultivars. Some cultivars such as Schmidt, Emperor Francis, and Giant may be sensitive to Captan. Do not apply more than 1 lb of Indar 75WSB per acre per year.

² Do not make more than two sequential applications of Pristine before alternating to a fungicide with another mode of action.

POSTHARVEST SPRAY¹

Disease	Effectiveness	Suggested Chemicals	100 Gal Dilute	Acre Concentrate
Leaf spot	E = 1, 2, 8, 11 G = 4, 5, 6, 9, 10	1. Dodine 65W 2. Bravo 720 (or equivalent a.i. of other formulation) 4. Indar 2F 5. Rally 40WSP 6. Rubigan 1E 8. Pristine 38 WDG 9. Procure 50WS 10. Elite 45DF 11. Adament 50WG	8 oz 1 – 1.2 pt 0.8 – 2 oz 2 – 4 oz 3.5 – 4.8 oz 3.3 – 5.3 oz 2.6 oz 8 oz 4 – 8 oz	1.2 lb 3.1 – 5.5 pt 6 fl oz 2.5 – 6 oz 6 – 12 oz 10.5 – 14.5 oz 10 – 16 oz 8 oz 4 – 8 oz

¹ Apply postharvest sprays as needed to prevent defoliation from leaf spot. Heavy, early defoliation increases susceptibility to winter injury. In wet years, continue to control leaf spot up to 3 weeks after harvest with at least one or two sprays during the postharvest period. Seven-day intervals may be needed when conditions are wet. Ten-day intervals are satisfactory when the weather is less favorable. To manage leaf spot when lesions are visible and where defoliation may be severe, tank mix an SI material at the full rate + captan at the full rate and apply twice postharvest at 7-day intervals then make a third application of Pristine 7 to 10 days later.