2. Comercial Small Fruit

Commercial Small Fruit: Diseases and Insects

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Effective control of pests that occur in commercial small fruit crops is obtained only through the judicious use of pesticides combined with sound management practices, nutrition, and sanitation. Close observation should be used to determine which pests are present and when treatments should be applied to be most effective. Pesticides are used most frequently by the grower for pest control, and they usually are applied as sprays or occasionally as dusts. The problem of selecting the correct pesticide to do a specific job continues to be challenging to commercial growers. The success or failure of any spray program is not due entirely to the specific pesticide or amount placed in the sprayer tank, but is also influenced by proper timing, thorough application, and weather conditions at the time of application.

The pesticides recommended here have proven to be effective and useful in the control of various common diseases and insects. Differences may exist among them in their effectiveness against specific pest organisms. It has become increasingly evident that no spray program can provide equally satisfactory results in all plantings for all pests. Use extreme caution and read label thoroughly when using highly toxic pesticides.

Integrated Pest Management (IPM) is the use of all suitable tactics to maintain a pest population below an economically damaging level. One such tactic is that of chemical control. Growers may use insecticides to quickly reduce a pest population that is not controlled by other means. Contrary to a commonly held belief, organic growers utilize chemical control as well as other, "conventional" growers. The difference lies in the nature of the insecticides selected – organic growers are restricted to naturally derived materials, generally botanical or mineral products, while conventional growers usually use synthetic materials. Many naturally derived insecticides are substantially less toxic and more environmentally selective than older materials.

Other IPM tactics are appropriately used by both types of growers, namely biological control (use of predators, parasites and pathogens), cultural control (modifying crop production procedures to suppress problems), physical control (exclusion and hand-picking), and resistant varieties.

Insecticides approved for organic production and noninsecticidal management tactics listed in this guide for small fruit insect pests include:

Strawberry: Mites – Stylet oil, Trilogy, predatory mites. Leafrollers – Entrust. Thrips – Aza-Direct and Entrust. Aphids – virus-free plants. Sap beetles – sanitation.

Caneberries: Rednecked cane borer – remove galled canes. Raspberry cane borer – remove infested canes. Blackberry psyllid – Surround. Mites – Stylet oil. Japanese beetle – Aza-Direct, Neemix/Trilogy, Surround.

Blueberries: Blueberry tip borer – remove infested tissue when pruning. Plum curculio – Surround. Cranberry/cherry fruitworms – Entrust. Mites – Stylet oil. Japanese beetle – Neemix/Trilogy.

In selecting a pesticide for control of small fruit pests, there are several factors that must be considered. Degree of control desired, type of fruit finish required by the market, type of spray used, compatibility with other pesticides, and effectiveness against other pests are some of the important factors that must be weighed. There are a large number of pesticides available for grower use which vary somewhat in their spectrum of activity and effectiveness on an individual pest.

Generally, pesticides may be used alone for a specific pest or in combination for various pests occurring at any one time.

The recommended concentration of pesticides for control of small fruit pests is based on a regular dilute (1X) spray. The application rate for strawberries is based on 100 to 150 gal per acre. The application rate on caneberries is based on 150 to 250 gal per acre.

For information on small fruit pests and their control, request Virginia Cooperative Extension (VCE) Publications 444-567, 456-232, and 456-018, as well as those listed elsewhere in this volume. Also, additional information on strawberry diseases and their control is available in VCE Publication 456-038. Information on pest and beneficial species identification and monitoring is also available on-line at *http://www.virginiafruit.ento.vt.edu/.* For additional information regarding pest management and small fruit production, consult the Mid-Atlantic Berry Guide, Virginia Cooperative Extension publication 423-020, *http://pubs.cas.psu.edu/freepubs/MABerryGuide.htm;* and the Southern Region Small Fruit Consortium, *http://www.smallfruits.org/SmallFruitsRegGuide/index.htm.*

Be alert for pesticide label changes, particularly with regard to post-application re-entry and pre-harvest interval restrictions.

Fungicide Resistance Guidelines: The gray mold fungus is now resistant to multiple fungicides in most strawberry fields in Virginia and nearby states. Resistance to Topsin-M has been found in every survey sample from Virginia, and resistance to many other fungicides has also been commonly found. Strawberry growers should focus fruit rot fungicide spray programs on broad-spectrum, "multi-site" products such as Captan and Thiram and use other products, when necessary, to increase efficacy and/or to control other diseases like anthracnose. Fruit rot spray programs should focus on the bloom period, starting promptly at 1st bloom. After peak bloom, sprays are usually beneficial only when wet weather conditions favor pathogen infection. Fungicide-resistant pathogens react similarly to products with the same mode of action (same "FrAC Group"). Loss of effectiveness is also a concern particularly for FrAC Group 11 (Abound and Quadris, Cabrio and Pristine, Flint, and Merivon). Pristine also contains boscalid, a FrAC Group 7 fungicide. Merivon also contains a Group 7 ingredient (fluxapyroxad), while Quadris Top also contains difenoconazole, a FrAC Group 3 fungicide. Because resistance is showing up to these partner fungicides as well, fungicides containing ingredients in Groups 7, 11, and 17 should not be applied in more than two consecutive sprays and no more than a total of 4-5 times per season. Group 11 fungicide sprays should be targeted on anthracnose control as much as possible. Fruit rot fungicides should be tank-mixed with Captan or Thiram whenever possible to avoid development of fungicide resistance. Interested growers can obtain a "fungicide resistance profile" of their strawberry fields by working with their county extension agent to submit blossom or fruit-swab samples to Clemson University for analysis.

Strawberries

Table 2.1a - Strawberry Diseases, Post-Planting

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Anthracnose Crown Rot (*Colletotrichum gloeosporioides*; *C. fragariae*)	Abound 2.08F Azaka	5.0-8.0 fl oz (dip)	—	For continued control, follow up with foliar applications 2 to 3 weeks after transplant.
	Switch 62.5WG	5.0-8.0 fl oz	—	For suppression only. Wash roots of bare-root plants to remove excess soil, then dip entire plants for 2 to 5 minutes, planting as quickly as possible.
Rhizoctonia sp. (seedling root & basal stem rot)	Abound 2.08F Azaka	—	0.4-0.8 fl oz /1,000 row feet	Spray before infection in narrow band (7 inches or less) centered over rows.

Table 2.1b - Strawberry Diseases, At Planting

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Anthracnose Crown Rot (*Colletotrichum gloeosporioides*; *C. fragariae*)	Abound 2.08F Azaka	5.0-8.0 fl oz (dip)	—	For continued control, follow up with foliar applications 2 to 3 weeks after transplant.
	Switch 62.5WG	5.0-8.0 fl oz	—	For suppression only. Wash roots of bare-root plants to remove excess soil, then dip entire plants for 2 to 5 minutes, planting as quickly as possible.
Anthracnose Crown Rot: *(Colletotrichum gloeosporioides; C. fragariae*) Or	<u>First bloom:</u> Captan 50W Captan 80WDG Captan Gold 80WDG Captan Gold 4L Captec 4L Captevate 68WDG Thiram 75 WDG Thiram 24/7 QoI <u>fungicides:</u> Pristine 38WDG Cabrio 20EG Merivon QuiltXcel Quadris Top Abound 2.08F Azaka Flint Orbit Tilt Protocol	- - - - - - - - - - - - - - - - - -	3-6 lb 1.9-3.8 lb 1.9-3.8 lb 1.5-3.0 qt 1.5-3.0 qt 5.25 lb 4.4 lb 2.6 qt 18.5-23.0 oz 12.0-14.0 oz 5.5-8.0 fl oz 14.0 fl oz 12.0-14.0 fl oz 6.2-15.4 fl oz 6.2-15.4 oz 2.0-3.2 oz 4.0 fl oz 4.0 fl oz 1.33 pt	When risk is high for anthracnose fruit rot, begin sprays at first bloom and continue on a 7 to 10-day schedule. The 1st spray should apply a Captan product, or Thiram, tank-mixed with a QoI fungicide, but do not use a QoI product in the 2nd spray. Use the same products in the 3rd spray that were used in the 1st, but rotate the fungicides applied each week thereafter. Other than Captan or Thiram, never make more than 2 sequential applications of a fungicide before alternating to another product with a different fungicidal mode of action (FRAC Group number). Under high anthracnose disease pressure, Pristine, Merivon, or Cabrio show the best efficacy. **Flint only suppresses anthracnose versus control**. Incorporate Switch into the fungicide rotation program when Botrytis pressure is also high.

Table 2.1b - Strawberry Diseases, Post-Planting (cont.)

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Anthracnose Fruit Rot: (*C. acutatum; C. fragariae*)	First bloom:			When risk is high for anthracnose fruit rot, begin sprays at first bloom and continue on a 7 to 10-day schedule. The 1st spray should apply a Captan product, or Thiram, tank-mixed with a QoI fungicide, but do not use a QoI product in the 2nd spray. Use the same products in the 3rd spray that were used in the 1st, but rotate the fungicides applied each week thereafter. Other than Captan or Thiram, never make more than 2 sequential applications of a fungicide before alternating to another product with a different fungicidal mode of action (FRAC Group number). Under high anthracnose disease pressure, Pristine, Merivon, or Cabrio show the best efficacy.
	Captan 50W	-	3-6 lb	
	Captan 80WDG	-	1.9-3.8 lb	
	Captan Gold 80WDG	-	1.9-3.8 lb	
	Captan Gold 4L	-	1.5-3.0 qt	
	Captec 4L	-	1.5-3.0 qt	
	Captevate 68WDG	-	5.25 lb	
	Thiram 75 WDG	-	4.4 lb	
	Thiram 24/7	-	2.6 qt	
	QoI fungicides:			**Flint only suppresses anthracnose versus control.** Incorporate Switch into the fungicide rotation program when Botrytis pressure is also high.
	Pristine 38WDG	-	18.5-23.0 oz	
	Cabrio 20EG	-	12.0-14.0 oz	
	Merivon	-	5.5-8.0 fl oz	
	QuiltXcel	-	14.0 fl oz	
	Quadris Top	-	12.0-14.0 fl oz	
	Abound 2.08F	-	6.2-15.4 fl oz	
	Azaka	-	6.2-15.4 oz	
	Flint	-	2.0-3.2 oz	
	Orbit	-	4.0 fl oz	
	Tilt	-	4.0 fl oz	
	Protocol	-	1.33 pt	

Table 2.1b - Strawberry Diseases, Post-Planting (cont.)

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Gray Mold Fruit Rot (Botrytis cinerea)	Rovral 4F	-	1.5-2.0 pt	Do not apply Rovral after first flower or more than once/season.
	Captevate 68WDG	-	3.5-5.25 lb	
	Elevate 50WDG	-	1.5 lb	
	Switch 62.5WSB	-	11.0-14.0 oz	Preventative fungicide sprays should begin at **first** bloom and continue on a 7- to 14-day interval, making no more than 2 sequential applications of any fungicide (other than Captan or Thiram) before alternating to another product with a different fungicidal mode of action (FRAC Group number). Ph-D, OSO, & Tavano can be substituted for Captan in the beginning of the season. Rates of Elevate may be lowered to 1.0 lb/A when tank-mixed with Captan or Thiram. For early spring sprays, 9.0 fl oz Scala can be sprayed when tank-mixed with Captan or Thiram.
	Fontelis	-	16-24 fl oz	
	Kenja 400SC	-	13.5-15.5 fl oz	
	Captan 50W	-	3.0-6.0 lb	
	Captan 80WDG	-	1.9-3.8 lb	
	Captan Gold 80WDG	-	1.9-3.8 lb	
	Captan Gold 4L	-	1.5-3.0 qt	
	Captec 4L	1.5-3.0 qt	1.5-3.0 qt	
	Thiram 65WSB	-	4.0-5.0 lb	
	Thiram 24/7	-	2.6 qt	
	Ph-D WDG	-	6.2 oz	
	OSO 5SC	-	6.5-13 fl oz	
	Tavano 5SC	-	6.5-13.0 fl oz	
	Pristine 38WSB	-	18.5-23.0 oz	
	Merivon	-	8.0-11.0 fl oz	
	Scala 600SC	-	18.0 fl oz	
	Fracture	-	24.4-36.6 fl oz	
Phytophthora	Ridomil Gold EC		1.0 pt	
Crown Rot *(P. cactorum)*	MetaStar 2E AG	-	1 qt (2.0 pt)	
Red Stele *(P. fragariae)*	Ultra Flourish	-	1 qt (2.0 pt)	
Leather Rot *(P. cactorum)*				

Table 2.1b - Strawberry Diseases, Post-Planting (cont.)

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Phytophthora (cont.) Crown Rot *(P. cactorum)* Red Stele *(P. fragariae)* Leather Rot *(P. cactorum)*	Phosphite products			Phosphite products may be applied as drip treatments just prior to (same day as) planting or as foliar sprays after planting. Foliar sprays after planting avoid possible spread of angular leaf spot.
	Aliette 80WDG	2.5 lb (dip)	2.5-5.0 lb (spray)	
	Agri-Fos	2.5 pt (dip)	2.5 pt (spray)	
	Phostrol	2.5 pt (dip)	2.5-5.0 pt (spray)	
	ProPhyt	2.0 pt (dip)	2.0-4.0 pt (spray)	
Powdery Mildew (*Sphaerotheca spp.)*	Rally 40W or WSP	1.6-3.2 oz	2.5-5.0 oz	Initiate applications at the first sign of infection. Repeat applications every 7-14 days, making no more than 2 sequential applications before alternating to another fungicide with a different mode of action (FAC Group number).
	Procure 50WS	–	4.0-8.0 oz	
	Procure 480SC	–	4.0-8.0 fl oz	
	Quintec	–	4.0-6.0 fl oz	
	Fontelis	–	10-24 fl oz	
	Kenja 400SC	–	13.5-15.5 fl oz	
	Flint	–	2.0-3.2 fl oz	
	Quadris Top	–	12.0-14.0 fl oz	
	Quilt Xcel	–	14.0 fl oz	
	Protocol	–	1.3 pt	
	Tilt	–	4.0 fl oz	
	Orbit	–	4.0 fl oz	
	Mettle	–	3.0-5.0 fl oz	
	Sulfur	–	5.0-10.0 lb	
	Torino	–	3.4 oz	
	Fracture	–	20.5-24.4 fl oz	
Angular Leaf Spot *(Xanthomonas fragariae)*	Various formulations of:	-	See labels	Scout fields regularly for first sign of disease after plant establishment. Avoid overhead irrigation/frost protection. Begin sprays at first sign of disease and continue on 7- to 10-day interval until conditions improve or first sign of crop injury from sprays.
	Basic copper sulfate	2.0-3.0 lb	-	
	Copper hydroxide		0.35-0.58 lb a.i.	
	Copper salts of fatty & rosin acids		3.0-4.0 pt	
	Cuprous Oxide		1.05-4.2 lb a.i.	Do not apply Actigard within 5 days of transplanting, or to plants stressed by drought or excessive moisture, cold, etc.
	Actigard 50W	-	0.5-0.75 oz	

Table 2.1b - Strawberry Diseases, Post-Planting (cont.)

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Leaf Spot *(Mycosphaerella fragariae)*	Rally 40W or WSP	-	2.5-5.0 oz	Begin applications as symptoms first appear and continue on a 7- to 14-day schedule as conditions warrant.
	Quadris Top	-	12.0-14.0 fl oz	
Leaf Scorch *(Marssonia fragariae)*	Protocol	-	1.3 pt	
	Pristine 38WG	-	18.5-23.0 oz	
Leaf Blight *(Phomopsis obscurans)*	Merivon	-	4.0-7.0 fl oz	
	Captan 50W	-	3.0-6.0 lb	
	Captan 80WDG	-	1.9-3.8 lb	
Leaf Blotch *(Gnomonia spp.)*	Captan Gold 80WDG	-	1.9-3.8 lb	
	Captan Gold 4L	-	1.5-3.0 qt	
	Captec 4L	-	1.5-3.0 qt	
	Orbit 3.6E	-	4.0 fl oz	
	Tilt	-	4.0 fl oz	
	Topsin-M WSB	-	0.75-1.0 lb	
	Topsin-M 4.5FL	-	15.0-20.0 fl oz	
	Rovral 4F	-	1.5-2.0 pt	
	Flint	-	3.0-5.0 fl oz	
	Mettle	-	3.0-5.0 fl oz	Flint suppresses leaf spots & blights versus controlling them.

Phytophthora diseases (crown rot, red stele, leather rot)

Phosphite-based products are less effective than Ridomil Gold, but should be considered when the pathogen is Ridomil-resistant or if root systems are significantly damaged but plants possess adequate foliage to absorb the product. For crown rot control, phosphite products may be applied by dipping transplants into a fungicide solution for 30 minutes just before (the same day as) planting. Foliar sprays with phosphites should begin 2-3 weeks after planting and be repeated on 30-60 day intervals. Begin spraying perennial plantings when plants start active growth in the spring. For leather rot control, begin phosphite sprays at 10% bloom and early fruit set and continue on a 7-14 day interval as long as conditions favor disease. Aliette may be applied the day of harvest (REI = 12 hr). Although Agri-Fos, Phostrol, and ProPhyt are labeled similarly to Aliette, check their labels for specific use instructions.

Ridomil Gold, MetaStar, and Ultra Flourish may each be applied up to 3 times/cropping season. For control of crown rot or red stele in annual plantings, applications can be made after transplanting, 30 days prior to harvest or fruit set, and during harvest. In established plantings, the first application should occur in the spring after the ground thaws and before first bloom, and the second in the fall after harvest. A supplemental application can be made at fruit set for leather rot control. Apply Ridomil Gold or MetaStar in sufficient water to move the product into the root zone. In drip-treatments, reduce the rate applied according to the ratio of bed-width to row spacing (example: 32 inch-wide bed/60 inch [5 ft] row spacing = 0.53; 0.53*1.0 pt/acre = 0.53 pt/acre for Ridomil Gold; 0.53 gal/acre for MetaStar).

Caution: Abound is extremely phytotoxic to some apple cultivars, including 'Gala' and 'McIntosh'. Contact with apples should be prevented between spray drift and leftover residue in spray tanks.
Pre-Harvest Spray Intervals: Abound, Actigard, Azaka, Cabrio, Captevate, Elevate, Flint, Fontelis, Inspire Super, Kenja, Mettle, MetaStar, Orbit, OSO, the phosphite products, Ph-D, Pristine, Quadris Top, QuiltXcel, Rally, Ridomil Gold, Switch, Tavano, Torino, and Ultra Flourish may be applied the day of harvest. Fracture, Procure, Protocol, Quintec, Scala and Topsin-M may be applied the day before harvest. Although the preharvest interval for Captan and Captec is 0 days, protective closing must be worn if entering the planting within 1 ay after Captan application. Preharvest intervals for most copper products are 2 days, and 3 days for Thiram.

Maximum Fungicide Uses per year: Abound – 1.9 qt; Actigard – 6.0 oz; Aliette – 30.0 lb; Azaka – 61.5 fl oz; Cabrio – 70.0 oz; Captan 80WDG – 30.0 lb; Captevate – 21.0 lb; Elevate – 6.0 lb; Flint – 19.2 oz; Fontelis – 72.0 fl oz; Fracture – 183 fl oz; Kenja – 54 fl oz; Mettle – 20 fl oz; MetaStar – 6.0 qt; Orbit – 16.0 fl oz; OSO – 78.0 fl oz ; Ph-D – 18.6 oz; Pristine – 115.0 oz; Procure – 32.0 oz; Protocol – 5.3 pt; Quadris Top – 56 fl oz; QuiltXcel – 56 fl oz; Quintec – 24.0 fl oz; Rally – 30.0 oz; Ridomil Gold – 3.0 pt; Scala – 54.0 fl oz; Switch – 56.0 oz; Tavano – 78.0 fl oz; Topsin-M – 4.0 lb; Torino – 6.8 oz; Ultra Flourish – 6.0 pt.

Table 2.2 - Strawberry Insects

Crop and Pest	Chemical and Formulation	Rate per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Preplant				
White grubs	diazinon AG500 Admire Pro	1.0 pt —	— 7.0-10.5 fl oz	Apply diazinon in 100 gal/A with boom sprayer. Do not plant strawberries immediately following sod. Fumigant may be also used. Apply Admire Pro at or just before transplanting, or in drip irrigation just before bud opening. Incorporate Admire Pro into soil with at least 0.25 inches of irrigation or rainfall within 2 hrs of application.
Aphids	Admire Pro	—	10.5-14.0 fl oz	
First Cover				
Spittlebug	Sevin XLR Danitol 2.4EC Admire Pro	— 10.6 fl oz —	2.0 qt — 1.3 fl oz	First cover: When blossom buds emerge 1/2 inch from crown. Apply with ground equipment with adequate water for uniform coverage (100-300 gal/A). See Table 2.7 for REI and PHI. It is advisable to delay use of Danitol if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
Strawberry clipper	Lorsban 4E Brigade WSB	1.0 pt 3.2-16.0 oz	1.0 qt 6.4-32.0 oz	Clipper: Prebloom use only; do not apply when berries are present. Early control is important. Treat when an average of 0.6 clipped buds/foot of row are found. Do not apply when berries are present. See Table 2.7 for REI and PHI

[1]Predatory mites (*Amblyseius fallacis*) are available commercially; these have been used effectively. Avoid use of Sevin, Brigade, and Danitol if predatory mites are used.

Table 2.2 - Strawberry Insects (cont.)

Crop and Pest	Chemical and Formulation	Rate per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Spider mites	Savey 50DF			Do not spray for mites on a preventive basis. Rotate acaricides to delay resistance. Do not apply an acaricide more than twice/season. Savey may be applied at the rate of 6.0 oz/A under intense population pressure. See Table 2.7 for REI and PHI. Acramite may be applied once per season. Use an organosilicone (See label.) [1]Consult distributors.
	Zeal 72WDG	—	2.0-3.0 oz	
	Oberon 2SC	—	12.0-16.0 oz	
	Acramite 50WS	0.4-0.5 lb	0.75-1.0 lb	
	Agri-Mek 0.15EC	8.0 fl oz	16.0 fl oz	
	Vendex 50WP	8.0 oz	2.0 lb	
	Stylet Oil	3.0 qt	—	
	Predatory mites[1]	—	—	
	Aza-Direct	—	11.5-42.0 fl oz	
	Kanemite 15SC	—	21.0-31.0 fl oz	
	Trilogy	—	2% solution	Nealta should be applied at the first sign of infestation. No more than one application of Nealta should be applied before changing to an acaricide of differing mode of action.
	Nealta 1.67WSP	—	13.7 fl oz	
Second Cover				
Tarnished plant bug	Rimon 0.83EC	—	6.0 oz	When blossoms separate in flower cluster. Treatment threshold is 1 nymph in every 1 to 2 flower clusters. See Table 2.7 for PHI and REI. Actara provides suppression only. Use of Danitol or Brigade should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications..
	Brigade WSB	3.2-16.0 oz	—	
	Danitol 2.4EC	10.7 fl oz	11.5-42.0 fl oz	
	Aza-Direct	—	4.0-6.9 oz	
	Assail 30SG	—	2.0-3.0 oz	
	Actara 25 WDG	—	4.0 oz	
Strawberry leafroller	Sevin XLR	—	2.0 qt	Strawberry leafroller is seldom a problem. Entrust is for organic management. Use of Radiant should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
	Dipel DF	—	0.5-1.0 lb	
	Entrust 80WP	—	1.25-1.5 oz	
	Radiant 1SC	—	6.0-10.0 fl oz	
	Assail 30SG	—	4.0-6.9 oz	
Thrips	Aza-Direct	—	12.5-42.0 fl oz	
	Entrust 80WP	—	1.25-1.5 oz	
	Radiant 1SC	—	6.0-10.0 fl oz	
	Assail 30SG	—	4.0-6.9 oz	
Strawberry clipper	See First Cover	—	—	—
Third Cover				
No insecticides at this time	—	—	—	At 10% bloom.
Fourth Cover				
No insecticides at this time	—	—	—	At 50% bloom.
Fifth Cover				
Tarnished plant bug	See Second Cover	—	—	Berries half-grown, 7 to 10 days after fourth cover. This second TPB spray may be needed. See note in Second Cover. Do not apply Thionex within 15 days of first spray or more than twice within 35 days after fruit are formed.

[1]Predatory mites (*Amblyseius fallacis*) are available commercially; these have been used effectively. Avoid use of Sevin, Brigade, and Danitol if predatory mites are used.

Table 2.2 - Strawberry Insects (cont.)

Crop and Pest	Chemical and Formulation	Rate per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
	Thionex 50W	—	2 lb	While endosulfan (Thionex) use on annual strawberries was terminated in 2012, use on perennial/biennial strawberries ends on July 31, 2016 (among the final legal use crop category).
Spittlebugs	See First Cover	—	—	—
Leafroller	See Second Cover	—	—	—
Spider mites	See First Cover	—	—	—
Strawberry aphid	Actara 25WG Assail 30SG M-Pede Aza-Direct Admire Pro	— — — — —	1.5-3.0 oz 1.9-4.0 oz 2% solution 11.5-42.0 fl oz 1.3 fl oz	Use virus-free plants. Admire Pro will not knock down heavy aphid populations.
Preharvest				
Sap beetles	Assail 30SG Malathion 5EC Danitol 2.4EC Rimon 0.83EC	— — 16.0-21.3 fl oz 12.0 fl oz	4.0-6.9 oz 1.5 pt — —	Harvest ripe fruit promptly and completely and remove from field. Pesticides not as effective as cultural methods. See Table 2.7 on REI and PHI.
Spotted wing Drosophila	Entrust 80 WP Brigade WSB PyGanic 1.4 EC Azera Malathion 5EC Radiant 1SC	— — — — — —	1.25–1.5 oz 16.0 oz 64.0 fl oz 2.0–3.0 pt 1.5 pt 6-10 fl oz	Harvest fruit promptly and completely. Rotate among available modes of ation to slow development of pesticide resistance. Use of malathion or Brigade should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
Post-Harvest				
Strawberry root weevil	Brigade WSB malathion 5EC	8.0-16.0 oz —	16.0-32.0 oz 1.5-2.5 pt	Where root weevil has been a problem, spray when leaf feeding appears.
Strawberry leafrollers	See Second Cover	—	—	Leafrollers and aphids may need to be controlled to ensure continued growth, especially in young plantings.
Strawberry aphid	See Fifth Cover			
White grubs	Admire Pro	—	7.0-10.5 fl oz	Apply at renovation; incorporate into soil and furrow with 0.25 inches of water (irrigation or rain).

Caneberries

Table 2.3 - Blackberry and Raspberry Diseases

Crop and Pest	Chemical and Formulation	Rate per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Anthracnose *(Elsinoe veneta)*	Dormant or late dormant sprays Liquid lime sulfur (24-31% solution)	–	See specific product label	**See fungicide use comments and Table 2.7 for specifics on fungicide use and for REI's, PHI's & maximum use rates for each fungicide.** Dormant or late dormant sprays: Spray in late winter or early spring when new growth is less than ¾ inch long. Lime-sulfur will likely burn any exposed green tissue, and will burn applicators as well as plants. At least 200 gallons of dilute spray per acre is recommended.
Cane Blight *(Leptosphaeria coniothyrium)*	Tavano 5SC	–	6.5-13.0 fl oz	Suppression only. Apply 6.5 fl oz/acre for preventative sprays or low disease pressure, otherwise use 13.0 fl oz/acre. No more than 6 applications at the maximum rate. Tavano 5SC/Polyoxin D zinc salt, and is labeled for anthracnose, but not for Cane or Spur Blight. Only the copper-based products are labeled for Cane & Spur Blight.
Spur Blight *(Didymella applanata)*	Copper-based products	–	See specific product label	Apply copper products before shoots are 3-4 inches long to avoid leaf burn. Copper can cause phytotoxicity on black raspberry, and occasionally on red raspberry, if used with formulated phosphorus acid products (Aliette, for example). Be sure to thoroughly clean equipment after using a copper product or liquid lime sulfur.
	Shoots 6" long to After-Harvest	–		Apply at bloom (shoots 8"-10" long), 2 weeks later, and in the fall after old canes have been removed.
	Cabrio	–	14 oz	Shoots 6" long to After-Harvest See fungicide use comments and Table 2.7 for specifics on fungicide use and for REI's, PHI's & maximum use rates for each fungicide.
	Abound	–	6.2-15.4 fl oz	
	Azaka	–	18.5-23 oz	
	Pristine	–	6.0-15.5 fl oz	
	QuiltXcel	–	14-21 fl oz	
Captan products	see specific product label			
	OSO	–	3.75-13.0 fl oz	
	Ph-D	–	6.2 oz	
	Tavano 5SC	–	3.75-13.0 fl oz	

Table 2.3 - Blackberry and Raspberry Diseases (cont.)

Crop and Pest	Chemical and Formulation	Rate per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Gray mold (*Botrytis cinerea*)	Pristine 38WDG	–	18.5-23.0 oz	Resistance to the active ingredients in Elevate and Pristine is an issue in many southeastern States. Caution: Abound is extremely phytotoxic to some apple cultivars. Prevent spray drift and leftover residue in the spray tank which may come in contact with apples.
	Elevate 50WDG	–	1.5 lb	
	Switch 62.5WG	–	11.0-14.0 oz	
	Rovral 4F, Nevado 4F, Iprodione 4L AG	0.5-1.0 pt	1.0-2.0 pt	
		–		
		–		
	Captan products	–	See labels	For use in rotating other fungicides for resistance management. No more than 6 applications at the maximum rate.
	OSO			
	Ph-D	–	3.75-13.0 fl oz	
	Tavano 5SC, Polyoxin D zinc salt	–	6.2 oz	
		–	3.75-13.0 fl oz	
	Abound 2.08F	–		
		–	6.2-15.4 fl oz	
Cane and Leaf Rust (*Kuehneola uredines*) Orange Rust (*Arthuriomyces peckianus, Gymnoconia nitens*) Yellow Rust (*Phragmidium rubi-idaei*)	Rally 40WSP	–	1.25-2.5 oz	Applications should be initiated as early as bud break and repeated at 10- to 14-day intervals, depending on the diseases to be controlled. Orange rust: April-June; cane and leaf rust: green tip and just before bloom; yellow leaf rust: April-May; late leaf rust: June-Sept.; powdery mildew: early white bud to full bloom; leaf spot: June-Aug.
	Orbit 3.6EC	–	6.0 fl oz	
	Tilt 3.6EC	–	6.0 fl oz	
	PropiMax 3.6E	–	6.0 fl oz	
	Cabrio	–	14 oz	
	Abound FL	–	6.2-15.4 fl oz	
	Azaka		6.0-15.5 fl oz	
	Pristine WG		18.5-23 oz	
	Quilt Xcel		14-21 fl oz	

Table 2.3 - Blackberry and Raspberry Diseases (cont.)

Crop and Pest	Chemical and Formulation	Rate per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Rosette or Double Blossom (*Cercosporella rubi*)	Abound FL	–	6.2-15.4 fl oz	
	Azaka	–	6.0-15.5 fl oz	
	Pristine W	–	18.5-23 oz	
	Quilt Xcel	–	14-21 fl oz	
	Switch 62.5WG		11-14 oz	
	Bordeaux mixture	8 lb Copper sulfate + 8 lb Calcium hydroxide		
Powdery mildew *(Sphaerotheca macularis)*	Rally 40WSP	-	1.25-2.5 oz	Use sulfur products only as dormant or late dormant sprays in late winter or early spring when new growth is less than ¾ inch long. Lime-sulfur will likely burn any exposed green tissue, and will burn applicators as well as plants. At least 200 gallons of dilute spray per acre is recommended.
	Cabrio	-	14 oz	
	Abound FL	-	6.2-15.4 fl oz	
	Azaka	-	6.0--15.5 fl oz	
	Pristine WG	-	18.5-23 oz	
	Sulfur-based products	-	See product label	
	Orbit 3.6EC	-	6.0 fl oz	
	Tilt 3.6EC	-	6.0 fl oz	
	PropiMax 3.6E	-	6.0 fl oz	
	Quilt Xcel	-	14-21 fl oz	
	OSO	-	3.75-13.0 fl oz	
	PhD	-	6.2 oz	
	Tavano 5SC	-	3.75-13.0 fl oz	
Leaf spots *(Sphaerulina rubi.)*	QuiltXcel	-	14-21 fl oz	Sprays for anthracnose, Botrytis gray mold, double blossom, and fruit rots should prevent Septoria infections.
	Orbit 3.6EC	-	6 fl oz	
	Tilt 3.6EC	-	6 fl oz	
	Propimax	-	6 fl oz	
	Cabrio	-	14 oz	
	Abound FL	-	6.2-15.4 fl oz	
	Azaka	-	6.0-15.5 fl oz	
	Pristine WG	-	18.5-23 oz	
	Captan Products		See specific product label	

Fungicide Use for Caneberry Diseases

"Bordeaux mixture" can be prepared using the following procedure:1-Fill spray tank to ½ the desired water volume; 2-Turn-on agitator; 3-dissolve powdered bluestone (copper sulfate)in spray tank at a rate of 4 lb bluestone/50 gallons of water; 4-make a "milk of lime" suspension by dissolving 4 lb of hydrated lime (calcium hydroxide) in 5 gallons of water in a container, for a rate of 4 lb hydrated lime/50 gallons water; 5-Slowly add "milk of lime" suspension into spray tank; 6-Fill spray tank to desired water volume; 7-maintain constant agitation and apply immediately. Do not mix with Topsin-M or Sevin. Bordeaux mixture will severely burn leaves if applied on very hot days or if combined with insecticides. Slight phytotoxicity will have relatively minor impact.

Captevate, MetaStar, and Ultra Flourish are labeled for raspberry but not blackberry.

If used, QuiltXcel sprays should begin before disease develops. In order to slow development of fungicide resistance, Cabrio, Abound, Azaka, Pristine, and QuiltXcel should be applied in no more than 2 sequential sprays before alternating with fungicides with a different mode of action. Cabrio, Abound, Azaka, Ph-D, and Pristine should also be applied in no more than a total of 4 applications per season, while no more than 3 total applications, of QuiltXcel, or more than 6 applications of OSO, Abound, Azaka, Cabrio, and Pristine are allowed per season. Do not make more than 4 applications of Rovral or Elevate per season. Resistance to the active ingredients in Elevate and Pristine is an issue in many southeastern States. **Caution: Abound is extremely phytotoxic to some apple cultivars. Prevent spray drift and leftover residue in the spray tank which may come in contact with apples.**

Pre-Harvest Spray Intervals: Abound, Agri-Fos, Azaka, Cabrio, Elevate, Lime Sulfur, OSO, Ph-D, Phostrol, Pristine, ProPhyt, Rally, Rovral, Switch, and Tavano may be applied the day of harvest. The preharvest interval for Captan, Captec and Captevate is 3 days. Preharvest intervals for most copper products are 2 days, but check the product label to be sure. Orbit, PropiMax, Tilt, and QuiltXcel must be applied at least 30 days before harvest, while MetaStar, Ridomil Gold, and Ultra Flourish have a preharvest interval of 45 days. Aliette can be applied no closer than 60 days before harvest.

Maximum Fungicide Uses per year: Abound – 92.3 fl oz; Aliette –4 applications; Azaka - 92.3 fl oz; Cabrio – 56.0 oz; Captan 80WDG – 12.5 lb; Captevate – 21.0 lb; Elevate – 6.0 lb; MetaStar – 2 applications; Orbit – 30.0 fl oz; OSO - 78 fl oz; Ph-D - 18.6 oz; Pristine – 92.0 oz; PropiMax – 30.0 fl oz; QuiltXcel – 105 fl oz; Rally – 10.0 oz; Ridomil Gold – 3.6 pt; Switch – 56.0 oz; Tavano - 78.0 fl oz; Tilt – 30.0 fl oz; Ultra Flourish – 2 applications.

Cane Blights

Spray from Delayed Dormant to After Harvest

Cane blights can cause significant losses to brambles, but in Virginia are often associated with winter injury. Cane blights can also be associated with pruning canes when they are over 3-4 feet in height (resulting in larger pruning wounds) and/or under wet, humid conditions. Cultural practices that promote quick drying of foliage, such as a weed-free strip under the canopy, will help reduce infection. If fungicides are applied, applications should be made as soon as possible after each pruning in order to maximize effectiveness. Applications made after pruning wounds have healed may not be effective. See http://www.smallfruits.org/bramble/pestinformation/caneblightfactsheetii.pdf for additional information.

Anthracnose

Nearby wild blackberries (within 500-1,000 ft) can be a source of infection and should be destroyed. Floricanes should be removed as soon as possible after harvest; new canes with signs of disease or insect injury should also be removed and burned or buried prior to budbreak. Good weed control below the canopy and proper thinning and sucker control will help reduce infection by allowing faster drying of canes and foliage. Erect blackberry varieties are more susceptible than procumbent cultivars. Liquid lime sulfur sprays should start before ¾" green tissue has formed. Additional liquid lime sulfur sprays may be applied
after primocanes become 6" tall and thereafter at 14-day intervals through harvest.

Orange Rust

Orange rust systemically infects black raspberry, blackberry, and wild dewberry. Blackberry varieties Cherokee, Cheyenne, Comanche, Choctaw (erect, thornless), Arapaho (erect, thornless), and Shawnee are considered resistant, although some disease has been observed on all varieties. Wild blackberries within 0.25 mile of planting should be eradicated. Preventative fungicide (Rally, etc.) applications can be effective, but new canes 12-18 inches tall should be inspected thoroughly, early in the season.

Note spindly emerging canes with fluorescent orange rust lesions on the underside of leaves. Uproot the entire plant, place it in a plastic bag, and remove it from the planting as soon as possible to reduce spread to healthy plants.

Leaf and Cane Rust

Nearby wild blackberries (within 500-1,000 ft) can be a source of infection and should be destroyed. Floricanes should be removed as soon as possible after harvest; new canes with signs of disease or insect injury should also be removed and burned or buried prior to budbreak. Good weed control below the canopy and proper thinning and sucker control will help reduce infection by allowing faster drying of canes and foliage. Fungicide sprays should be applied at green tip and prior to bloom, and then resumed after harvest until floricanes have been removed. Further sprays after primocane removal should be delayed until new infections are observed on primocanes.

Phytophthora Root Rot

Aliette 80WDG is registered for control of Phytophthora root rot on all caneberries. Apply as a foliar spray at the rate of 5 lb/A in new plantings. Applications should begin when plants produce 1-3 inches of new growth. Applications in established plantings should begin when conditions favor disease development. Begin foliar sprays in the spring after bud break (1-3 inches of new growth) and continue spraying on a 45-60 day schedule, up to a maximum of 4 sprays during the growing season. The last fall application should be applied at least 30 days prior to leaf drop. Do not mix Aliette with surfactants or foliar fertilizers. Do not apply Aliette within 60 days of harvest. Several other phosphorous acid products are labeled as foliar sprays for Phytophthora root rot control, including Agri-Fos, Phostrol, and ProPhyt. Ridomil Gold SL and Ultra Flourish are registered for use on both blackberries and raspberries, but Ridomil Gold GR and MetaStar are labelled for use on raspberries, but not blackberries.

Ridomil Gold GR, MetaStar 2E AB, and Ultra Flourish are labeled for control of Phytophthora root rot on raspberries only. Apply 4 fl oz of Ridomil Gold EC, 5.0 lb of Ridomil Gold GR, 1.0 pt (16.0 fl oz) of MetaStar 2E AG, or 0.5 pt (8 fl oz) of Ultra Flourish/1,000 linear feet of row to the soil surface in a three-foot band over the row. Make one application in the spring before new growth starts and another in the fall after harvest. Use the formula in the general information section of the appropriate label to calculate the amount of fungicide needed per acre. On a broadcast basis, Ridomil Gold GR is applied at 72.0 lb/A. Do not apply any of these fungicides within 45 days before harvest or possibly illegal residues may result.

Botrytis Gray Mold

Blossom blight and disease spread to ripening fruit can be controlled by sprays starting at early bloom and continuing through full bloom to near harvest. However, the pathogen has developed resistance to multiple fungicides. Growers should follow fungicide resistance management recommendations closely to avoid crop losses. Pre-harvest sprays are usually not necessary for blackberry unless weather is cool and wet.

Rosette (double blossom)

Blackberry varieties can vary in resistance to rosette or double blossom: Apache, Navaho, and Humble are largely resistant, while Shawnee, Choctaw, Chickasaw and Black Satin are highly susceptible. Sprays should start when rosettes are blooming and primocanes begin to grow. Witches-brooms should be clipped-out as they develop and before they flower. Prompt removal and destruction of floricanes after final harvest will help prevent or limit this disease. If disease pressure is high, cut all canes after harvest to 12-18 inches tall, fertilize heavily, and irrigate regularly to increase cane production for the following year.

Powdery mildew

Powdery mildew is usually not a problem, but some western cultivars are very susceptible. Fungicide treatments should begin at the first sign of disease and continue at 10-14 day intervals.

Crown Gall

All caneberries can be affected by crown gall, which causes canker-like growths on roots and stems. Galls look greenish-white at first, but then turn tan-to-brown, and then black. Planting tissue-cultured stock will help avoid introducing the disease to a field. This is particularly important because the bacterial pathogen can persist in soil once introduced. Wounds in roots and lower sterms are required for infection. Allow wounded root pieces to heal before planting; prune above-ground plant parts

when several days of dry weather are expected, and avoid wounding plants during cultivation or from herbicides. Dips for root cuttings at planting can provide additional insurance against this disease

Viruses

A number of viruses are common and can be significant problems in bramble production. However, apparent symptoms don't always reliably indicate their presence. Specific tissue tests must be conducted to verify a virus diagnosis. No control measures are available for bramble viruses, other than rapid removal of symptomatic plants in order to slow plant-to-plant spread. Since viruses can be introduced through propagation, clean planting stock is essential. Although tissue-cultured plants can't be guaranteed to be virus-free, they are more likely to be free of viruses and crown gall, and are highly recommended. Destruction of wild blackberries within 100-200 yards of a commercial planting may help reduce possible spread. Avoiding or minimizing dagger nematodes in the soil can also be important, as these nematodes can be virus vectors.

Comments about the use of copper fungicides on caneberries

Copper fungicides have been used for caneberry disease control (rusts, for example), even though these materials can be phytotoxic to caneberries and cause damage. However, other products of different chemical classes are now registered that are highly effective on targeted diseases. For example, Rally, Orbit and PropiMax should be effective for managing rust diseases. These products do not have the broad phytotoxicity concerns of the copper materials, but they do have potential fungicide-resistance concerns. Thus, you may want to consider using copper fungicides according to their labels for economic and/or resistance management reasons. Always use a product only in accordance with the label for that particular formulation, as application timing and target diseases may vary with the formulation. Again, caution is advised in using any copper product.

Table 2.4 - Caneberry Insects

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Dormant				
Raspberry crown borer and rednecked cane borer	—	—	—	Removal of infested canes during winter pruning is an effective cultural control for these borers.
Prebloom				
Leafrollers	Confirm 2F Delegate 25WG Dipel ES M-Pede Brigade 10WSB Entrust 80WP Sniper 2	— — — 2.0 gal — — —	16.0 fl oz 3.0-6.0 oz 1.0-4.0 pt 2% solution 8.0-16.0 oz 1.25-2.0 oz 3.2-6.4 fl oz	When buds are breaking or new canes are 6 to 8 inches long. See label for timing. Confirm sprays. See Table 2.7 for REI and PHI. Use of Delegate, Brigade or Sniper 2 should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
Raspberry sawfly	M-Pede Delegate 25WG Entrust 80WP	2.0 gal — —	2% solution 3.0-6.0 oz 1.25-2.0 oz	Use of Delegate should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
Blackberry psyllid	Malathion 57EC Surround 95WP	— —	3.0 pt 12.5-50.0 lb	Spray for psyllid when adults appear on plants. Surround provides suppression. Use of malathion should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
Raspberry cane borer	Malathion 57EC M-Pede	— 2.0 gal	3.0 pt 2% solution	For cane borer remove all infested canes; prune within a few days after wilted tips appear to minimize tissue removed. Spray just before blossoms open.

Table 2.4 - Caneberry Insects (cont.)

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Raspberry fruitworm	Delegate 25WG	—	3.0-6.0 oz	Use of Delegate should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
	Entrust 80WP	—	1.25-2.0 oz	
Stink bug (inc. Brown marmorated stink bug) and Tarnished plant bug	Sevin XLR Plus 44EC	—	2.0 qt	Apply when one TPB (Tarnished plant bug) in every two flower clusters. Do not apply more than 6.0 oz/A of Actara per session. After an Actara application, wait at least five days before placing beehives in treated fields. No more than five applications of Assail per season. Sevin not effective for BMSB.
	Brigade 10WSB	—	8.0-16.0 oz	
	Actara 25WDG	—	3.0 oz	
	Sniper 2	—	3.2-6.4 fl oz	
Thrips	Aza-Direct	—	12.5-42.0 fl oz	Just before blossoms open. Admire Pro soil-applied.
	Assail 30SG		4.5-5.3 oz	
	malathion 57EC		1.5 pt	
	Admire Pro	—		
	Entrust 80WP	—	2.8 fl oz	
	Delegate 25WG	—	1.25-2.0 oz	
			3.0-6.0 oz	
Clipper	Brigade 10WSB	—	16.0 oz	Use of Brigade or Danitol should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
	Danitol	—	10.66-16.0 fl oz	
Raspberry crown borer	Brigade 10WSB	—	16.0 oz	Apply as a drench in at least 200 gal of water/A, either prebloom or post harvest but not both. Use of Brigade or Sniper 2 should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
	Sniper 2	—	6.4 fl oz	
First Cover: at petal fall				
Aphids	Malathion 57EC	—	3.0 pt	Admire Pro soil-applied. Use of malathion should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
	Asana XL		4.8-9.6 fl oz	
	Sevin XLR Plus 44EC	—	2.0 qt	
	M-Pede	2.0 gal	2% solution	
	Assail 30SG	—	2.5-5.3 oz	
	Actara 25WG	—	2.0-3.0 oz	
	Admire Pro	—	2.8 fl oz	
Red-necked cane borer	Malathion 57EC	—	3.0 pt	Spray every 7 to 12 days from early May to early June if this pest has been a problem. Remove galled canes in early spring. Use of malathion or Bridage should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
	Brigade 10WSB	—	8.0-16.0 oz	

Table 2.4 - Caneberry Insects (cont.)

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Thrips	See Prebloom Spray			
	Admire Pro		2.8 fl oz	
Leafrollers	See Prebloom Spray			
Blackberry psyllid	See Prebloom Spray			
Leafhoppers	Malathion 57EC	—	1.5 pt	Use of malathion should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
	M-Pede	2.0 gal	2% solution	
	Assail 30SG	—	2.5-5.3 oz	
	Admire Pro	—	2.8 fl oz	
Rose scale	Admire Pro	—	2.8 fl oz	Use of Brigade should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
	Assail 30SG	—	4.0 - 5.3 oz	
	Brigade 2EC	—	3.2-6.4 fl oz	
	Tri-Tek	—	2% solution	
Second Cover: ten days after petal fall				
Aphids	See First Cover			
Brown marmorated stink bug	Actara 25WDG	—	3.0 oz	Do not apply more than 6 oz/A of Actara per season. After an Actara application, wait at least 5 days before moving bee hives into treated fields. Use of malathion, Brigade or Sniper 2 should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
	Brigade 10WSB	—	8.0-16.0 oz	
	malathion 57EC	—	3.0 pt	
	Sniper 2	—	3.2-6.4 fl oz	
Mites	Savey 50DF	—	6.0 oz	Savey is highly effective against mite eggs. If many active mites are present, an adulticide should be applied. PHI is 3 days. Use of Brigade should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
	Stylet Oil	3.0-6.0 qt	—	
	Brigade 10WSB	—	8.0-16.0 oz	
	Acramite 50WS	—	0.75-1.0 lb	
	Zeal 72WSB	—	2-3 oz	
	Kanemite 15SC	—	31 fl oz	
Third Cover				
Japanese beetle	Sevin 80S	1.0 lb	2.0 lb	Twenty days after petal fall.
	Sevin XLR Plus 44EC	—	2.0 qt	
	Admire Pro	—	7.0 - 14.0 fl oz (soil) 2.8 fl oz (foliar)	
	Aza-Direct	—	12.5-42.0 fl oz	
	Assail 30SG	—	4.5-5.3 oz	Neemix/Trilogy mix every 7-10 days. See label for Trilogy mixing instructions. Neemix and Trilogy are OMRI-certified.
	Actara 25WG	—	3.0 oz	
	Neemix 4.5 plus	—	7.0-16.0 fl oz +	
	Trilogy 70	—	2% solution	
	Surround 95WP	—	12.5-50 lb	Surround provides suppression. Recommended only for 1st three weeks following fruit set in fresh market berries because of visible residues.

Table 2.4 - Caneberry Insects (cont.)

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Spotted Wing Drosophila	Entrust 80WP	—	1.25-2.0 oz	Open pruning will aid in SWD management, as will prompt harvest of ripe berries. Spray timing must be at least every 7 days in many cases. Rotate modes of action in order to delay the development of pesticide resistance. Observe seasonal maximum number of applications: Danitol 2 applications, malathion 4 applications, bifenthrin 2 applications, Entrust and Delegate 6 applications. Season limits to product applied may also apply; check the label. Addition of table sugar at the rate of 30 oz per 100 gal will aid in efficacy of chemical control of SWD.
	Delegate 25WDG	—	3.0-6.0 oz	
	Malathion 57EC	—	3.0 pt	
	Mustang Max	—	4.0 oz	
	Asana	—	4.8-9.6 fl oz	
	Brigade 10WSB	—	16.0 oz	
	PyGanic 1.4EC	—	64.0 fl oz	
	Azera	—	2.0-3.0 pt	
Brown marmorated stink bug	Actara 25WDG	—	3.0 oz	
	Assail 30SG	—	4.5-5.3 oz	
	Azera	—	2.0-3.0 pt	
	Brigade 10WSB	—	8.0-16.0 oz	
	Malathion 57EC	—	3.0 pt	
	PyGanic 1.4EC	—	64.0 fl oz	
	Sniper 2	—	3.2-6.4 fl oz	
Click beetles	Malathion 57EC	—	2.0 pt	Spray for pests as needed. Do not apply within 1 day of harvest.
Aphids	See First Cover			
Mites	See Second Cover			
Post Harvest				
Raspberry crown borer	Sevin XLR Plus 44EC	—	2.0 qt	Sevin may be applied as foliar spray. Apply Brigade as drench in at least 50 gal of water either postharvest or prebloom but not both.
	Brigade 10WSB	—	16.0 oz	
	Altacor 35WDG	—	4.0 - 5.3 oz	
Aphids	See First Cover			Spray for pests if needed.
Mites	See Second Cover			
Leafhoppers	See First Cover Spray			
Rose Scale	Admire Pro	—	2.8 fl oz	
	Brigade 2EC	—	3.2-6.4 fl oz	
	Tri-Tek	—	2% solution	

Blueberries

Table 2.5 - Blueberry Diseases

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Mummy Berry Cups *(Monilinia vaccinii-corymbosi)*	50% urea mix	—	200.0 lb	Apply when cups appear (usually). **Delayed Dormant** Urea mix is 50% Urea sprills plus 50% inert materials. It supplies 45 lbs/A nitrogen. Cups may also be covered with 1 to 2 inches soil by discing or raking.

Table 2.5 - Blueberry Diseases (cont.)

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Phomopsis Twig Blight *(Phomopsis* spp.)	lime sulfur or Ziram 76DF or Abound 2.08F or Pristine 38WG or Switch 62.5WG or Indar 2F or Captan 80WG	2.5 gal 1.5 lb — — — — —	5.0 gal 3.0 lb 6.2-15.4 fl oz 18.5-23.0 oz 11.0-14.0 oz 6.0 fl oz 3.1 lb	Lime sulfur : Make **One Delayed Dormant** application. Do not use lime sulfur within 14 days of an oil spray or when temperature is above 75°. Leaf burn may occur when used during periods of warm temperature. Apply Ziram at loose bud scale stage and 7 days later. Do not apply more than two sequential applications of Abound or Pristine before alternating with a fungicide that has a different mode of action. Begin applications before disease development and continue on a 7- to 14-day schedule, following resistance management guidelines. Do not make more than 4 applications of Indar. Do not apply more than 1.44 qt of Abound or 92 oz of Pristine or 56 oz of Switch, 43.7 lb of Captan, or 24 fl oz of Indar/A/year. Do not apply Indar within 30 days of harvest. Abound, Pristine, and Switch may be applied the day of harvest. **Caution: Abound is extremely phytotoxic to some apple cultivars including 'Gala.' Prevent spray drift and leftover residue in the spray tank which may come in contact with apples.**
Mummy Berry Twig/fruit infection	Abound 2.08F Pristine 38WG Captevate 68WDG Switch 62.5WG Indar 2F Orbit 3.6E PropiMax 3.6E Tilt 3.6E Propimax 3.6E Bumper 41.8EC Quash 50WDG Quilt Xcel	— — — — — — — — — — — —	6.2-15.4 fl oz 18.5-23.0 oz 4.7 lb 11.0-14.0 oz 6.0 fl oz 6.0 fl oz 6.0 fl oz 6.0 fl oz 6.0 fl oz 6.0 fl oz 2.5 oz 14-21 fl oz	Begin Bravo applications at budbreak and repeat through early bloom at 10-day intervals. Read the Bravo label for cautions regarding tank mixing and phytotoxicity. Do not apply Bravo after full bloom or within 42 days of harvest. Do not apply more than 12.0 pt of Bravo/A/year. Do not apply more than two sequential applications of Abound, Pristine, or Captevate before alternating with a fungicide that has a different mode of action. Begin applications before disease development and continue on a 7- to 14-day schedule, following resistance management guidelines. For control of mummy berry with Indar or Orbit, make the first application at early greentip and make subsequent applications at 8- to10-day intervals. Do not make more than 4 applications of Indar. Do not apply more than 24.0 fl oz of Indar, 30.0 oz of Orbit, 43.7 lb of Captan, 92.0 oz of Pristine, 21.0 lb of Captevate, 1.44 qt of Abound, or 56.0 oz of Switch/A/year. Do not apply Indar or Orbit within 30 days of harvest. Pristine, Abound, and Switch may be applied the day of harvest. **Caution: Abound is extremely phytotoxic to some apple cultivars including 'Gala.' Prevent spray drift and keep leftover residue in the spray tank from contact with apples.**

Table 2.5 - Blueberry Diseases (cont.)

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Concentration	Spray Timing and Remarks
Fruit Rots (Anthracnose, Alternaria rot, *Glomerella cingulata*)	Captan 80WDG or Ziram 76DF or Bravo Weather Stik 6F or Abound 2.08F or Pristine 38WG or Switch 62.5WG or Orbit 3.6E or Captevate 68WDG or	— 1.5 lb — — — — — —	3.1 lb 3.0 lb 3.0-4.0 pt 6.2-15.4 fl oz 18.5-23.0 oz 11.0-14.0 oz 6.0 fl oz 4.7 lb	**Early Bloom to Post Bloom,** 7- to 10-day intervals. Observe pre-harvest and re-entry restrictions. Do not apply more than 43.7 lb of Captan/A/year. Begin Bravo applications at budbreak and repeat through early bloom at 10-day intervals. Read the Bravo label for cautions regarding tank-mixing and phytotoxicity. Do not apply Bravo after full bloom or within 42 days of harvest. Do not apply more than 12.0 pt of Bravo/A/year. Begin Abound applications before disease development and continue on a 7- to 14-day schedule, following resistance management guidelines. Do not apply more than two sequential applications of Abound, Pristine, or Captevate before alternating with a fungicide that has a different mode of action. Do not apply more than 1.44 qt of Abound, 92.0 oz of Pristine, 21.0 lbs of Captevate or 56.0 oz of Switch/A/year. Pristine, Switch, and Abound may be applied the day of harvest. **Caution: Abound is extremely phytotoxic to some apple cultivars including 'Gala.' Prevent spray drift and leftover residue in the spray tank which may come in contact with apples.** Do not apply Orbit within 30 days of harvest or more than 30 fl oz/A/year.
	Tavano 5SC	—	3.75-13.0 fl oz	**Suppression only for anthracnose**. Use 6.5 fl oz/acre for anthracnose prevention, for low disease pressure, and when tank-mixed with other fungicides for resistance management; otherwise, use 13.0 fl oz/acre for anthracnose. No more than 6 applications of the maximum rate.
Leaf Spots (*Gloeosporium minus, Gloeocercospora inconspicua*, *Septoria albopunctata*, *Dothichiza caroliniana*, *Alternaria tenissima* and *Glomerella cingulata*)	Captan 80WDG or Pristine 38WG or Indar 2F	— — —	3.1 lb 18.5-23.0 oz 6.0 fl oz	**Post Bloom to August at 7- to 10-day intervals**. Observe pre-harvest and re-entry regulations. For leaf spot control after harvest, resume spray schedule 1 to 2 times. Arrange season-long schedule to include not more than two sequential sprays of Pristine or the related material, Abound. Do not make more than 4 applications of Indar. If the maximum for Pristine and Abound has been used through harvest, select Captan for post-harvest sprays. Do not apply more than 24.0 fl oz of Indar/A/year. Do not apply Indar within 30 days of harvest or more than 30.0 fl oz/A/year.

Phytophthora root rot control

Ridomil Gold EC, MetaStar 2E AG, and Ultra Flourish are labeled for control of Phytophthora root rot of blueberries. **Established plantings:** Apply 4 fl oz of Ridomil Gold EC, 1 pt of MetaStar 2E AG, or 0.5 pt (8.0 fl oz) of Ultra Flourish per 1000 linear feet of rot (3.6 pt per acre of Ridomil Gold EC, 14.5 pt of MetaStar 2E AG, or 7.2 pt of Ultra Flourish on a broadcast basis) in a three-foot band over the row before the plants start growth in the spring. One additional application may be made to coincide with periods most favorable for root rot development. **New plantings:** Broadcast apply 3.6 pt per acre of Ridomil Gold, 2 gal per acre of MetaStar 2E AG, or 7.2 pt of Ultra Flourish to the soil at or after planting. Supplemental applications of Ridomil Gold or MetaStar should be made at 2- to 3-month intervals or to coincide with periods most favorable for root rot development. An 18-inch width is recommended for banded applications. Use the formula in the general sections of the labels to calculate the amount of fungicide needed per acre. On new plantings, do not broadcast apply more than 0.9 gal per acre of Ridomil Gold EC, 3.6 gal per acre of MetaStar 2E AG, or 7.2 pt per acre of Ultra Flourish broadcast during the 12 months before bearing harvestable fruit or illegal residues may result.

Aliette 80WDG is registered on blueberries at 5.0 lb per acre for control of Phytophthora root rot and suppression of some fruit rots. Begin foliar sprays at approximately the pink bud stage and continue on a 14- to 21-day interval. Do not exceed four applications or 20 lbs per acre per year. Do not apply in less than 10 gal per acre of water or closer than 12 hours to harvest. Several other phosphorous acid products are labeled as foliar sprays for Phytophthora root rot control, including Agri-Fos, Phostrol, and ProPhyt. See labels for specific use instructions and rates.

Table 2.6 - Blueberry Insects

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Conc.	Spray Timing and Remarks
First Cover: at petal fall. (Petal fall spray is the single most important spray for blueberry insects)				
Blueberry tip borer	Sevin XLR Plus	—	2.0 qt	Removing dead canes at pruning aids in control of tip borer. Use of malathion should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
	Malathion 57EC	—	1.5 pt	
Plum curculio	Sevin XLR Plus	—	2.0 qts	Two applications may be required for plum curculio. Surround provides suppression. Recommended only for 1st three weeks following fruit set for fresh berries because of visible residues. Use of Malathion or Exirel should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
	Surround 95WP	—	12.5-50.0 lb	
	Imidan 70W	—	1.5 lb	
	Malathion 57EC	—	2.0 pt	
	Exirel 0.83	—	13.5-20.5 fl oz	
Cranberry fruitworm and cherry fruitworm	Altacor	—	3.0-4. oz	Do not apply more than 64.0 fl oz of Confirm/A/ season. Use of Delegate, Malathion or Mustang Max should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications. Use of Exirel should be delayed if spotted wing drosophila will be a target later.
	Intrepid 2F	—	10.0-16.0 fl oz	
	Entrust 80W	—	1.25-2.0 oz	
	diazinon 50W	—	1.0 lb	
	Sevin XLR Plus	—	1.0-2.0 qt	
	Dipel ES	—	1.0-4.0 pt	
	Esteem 35WP	—	5.0 oz	
	Delegate 25WG	—	3.0-6.0 oz	
	Malathion 8F	—	1.25 pt	
	Assail 30SG	—	4.5-5.3 oz	
	Asana XL	—	4.8-9.6 fl oz	
	Rimon 0.83EC	—	20.0-30.0 fl oz	
	Confirm 2F	—	16.0 fl oz	
	Mustang Max 1.5EC	—	4.3 fl oz	
	Avaunt	—	3.5 - 6.0 oz	
	Exirel 0.83	—	10-13.5 fl oz	

Table 2.6 - Blueberry Insects (cont.)

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Conc.	Spray Timing and Remarks
Gall Midge	diazinon AG500 Delegate 25WG Entrust 80W Malathion 57EC Exirel 0.83	— — — — —	1 pt 3.0 - 6.0 oz 1.25 - 2.0 fl oz 1.5 fl oz 13.5-20.5 fl oz	Use of Exirel, Delegate or Entrust should be delayed if spotted wing drosophila will be a target later.
Second Cover: ten days after first cover				
Cranberry fruitworm and cherry fruitworm	See First Cover			
Brown marmorated stink bug	Actara 25WDG Lannate SP Malathion 57EC	— — —	4.0 oz 1.0 lb 1.5 pt	After an Actara application, wait at least 5 days before placing beehives in treated fields. If flowering plants are present in the ground cover, mow before applying Actara. Use of Malathion should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
Leafrollers	Confirm 2F Delegate 25WG	— —	16.0 fl oz 3.0-6.0 oz	See label for timing Confirm sprays. Use of Delegate should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
Aphids	M-Pede Admire Pro Actara 25WG Assail 30SG Exirel 0.83	2.0 gal — — — —	— 1.0-1.4 fl oz 3.0-4.0 oz 4.5-5.3 oz 13.5-20.5 fl oz	Repeated sprays of M-Pede may be needed. Do not apply M-Pede within 3 days of sulfur. Use of Exirel should be delayed if spotted wing drosophila will be a target later.
Blueberry tip borer	See First Cover			
Plum curculio	See First Cover			
Preharvest				
Blueberry maggot	Entrust 80W Imidan 70W Surround 95WP Danitol 2.4EC Delegate 25WG Malathion 57EC Admire Pro Assail 30SG Asana XL Sevin XLR Rimon 0.83EC GF-120 Exirel 0.83	— — — — — — — — — — — —	1.25-2.07 oz 1.5 lb 12.5-50.0 lb 10.7-18.0 fl oz 3.0-6.0 oz 1.5 pt 2.1 - 2.8 fl oz 4.5-5.3 oz 9.6 fl oz 1.0-2.0 q 20.0-30.0 fl oz 10.0-20.0 fl oz 13.5-20.5 fl oz	Spray if flies trapped for two consecutive weeks, or three flies/week. Delegate provides suppression. See Table 2.7 for PHI. See footnote petal fall spray. GF-120 NF Naturalyte fruit fly bait. Spot or strip spray several areas of inner canopy (1.0-3.0 fl oz/tree). OMRI-approved

Table 2.6 - Blueberry Insects (cont.)

Crop and Pest	Chemical and Formulation	Rate Per 100 Gal Dilute	Acre Conc.	Spray Timing and Remarks
Brown marmorated stink bug	Actara 25WDG Assail 30SG Azera Lannate SP Malathion 57EC	— — — — —	4.0 oz 4.5-5.3 oz 2.0-3.0 pt 1.0 lb 1.5 pt	After an Actara application, wait at least 5 days before placing beehives in treated fields. If flowering plants are present in the ground cover, mow before applying Actara. No more than 5 applications per season of Assail. Residual activity of Azera will be short.
Spotted Wing Drosophila	Entrust 80WP malathion 57EC Imidan 70W Lannate SP Delegate 25WG Mustang Max Danitol 2.4EC Asana XL Brigade 10WSB PyGanic 1.4EC Azera Exirel 0.83	— — — — — — — — — — — —	1.25-2.0 oz 2.0 pt 1.5 lb 0.25-0.5 lb 3.0-6.0 oz 4.0 oz 10.7-18.0 fl oz 9.6 fl oz 16.0 oz 64.0 fl oz 2.0-3.0 pt 13.5-20.5 fl oz	Open pruning will aid in SWD management, as will prompt harvest of ripe berries. Spray timing must be at least every 7 days in many cases. Rotate modes of action in order to delay the development of pesticide resistance. There is a 24(c) label for malathion 8F allowing 2.5 pt for SWD. Addition of table sugar at the rate of 30 oz per 100 gal will aid in efficacy of chemical control of SWD.
Mites	Stylet oil Acramite 50WS	3.0-6.0 qt —	— 0.75-1.0 lb	Acramite non-bearing only. Spray Stylet oil every 7 to 10 days while mite eggs persist.
Japanese beetle	Admire Pro Danitol 2.4EC Malathion 57EC Assail 30SG Asana XL Sevin XLR Actara 25WG Neemix 4.5 plus Trilogy 70	— — — — — — — — —	1.0 - 1.4 fl oz 10.7-18.0 fl oz 1.5 pt 4.5-5.3 oz 4.8-9.6 fl oz 1.0-2.0 qt 4.0 oz 7.0-16.0 fl oz + 2% solution	Apply Neemix/Trilogy over 7-10 days. See Trilogy label for mixing instructions. Neemix and Trilogy are OMRI-certified.
Special Soil Treatment				
Japanese beetle	Admire Pro	—	7.0 - 14.0 fl oz	Apply as chemigation or in band followed by irrigation.

Small Fruit Pesticides

Table 2.7 - Chemical Names, Re-entry Intervals (REI) and Preharvest Intervals (PHI)

Chemical	Manufacturer	Re-entry Interval	Preharvest Interval		
			Strawberry	Caneberries	Blueberry
Fungicides					
Abound (Azoxystrobin)	Syngenta	4 hours	0 days	0 days	0 days
Actigard	Syngenta	12 hours	0 days	—	0 days
Agri-Fos	Monterey	4 hours	0 days	0 days	0 days
Aliette (fosetyl Al)	Bayer CropScience	12 hours	12 hours	60 days	12 hours
Azaka	Cheminova	4 hours	0 days	0 days	0 days
Bordeaux mixture (coppers)	various	24 hours	—	(see label)	—

Table 2.7 - Chemical Names, Re-entry Intervals (REI) and Preharvest Intervals (PHI) (cont.)

			Preharvest Interval		
Chemical	**Manufacturer**	**Re-entry Interval**	**Strawberry**	**Caneberries**	**Blueberry**
Bravo Weather Stik (Chlorothalonil)	Syngenta	12 hours (See label for eye protection requirements up to 6.5 days after REI expires.)	—	—	42 days
Cabrio (pyraclostrobin)	BASF	24 hours 12 hours (strawberries)	0 days	0 days	0 days
Captan (Captan, Captec)	Micro Flo, etc.	see label	0 days (see label)	3 days (Captan 80WDG)	0 days (see label)
Captevate (Captan & fenhexamid)	Arysta	24 hours (strawberries) 48 hours (blueberries & raspberries)	0 days	3 days (raspberries)	0 days
Elevate (fenhexamid)	Arysta	12 hours	0 days	0 days	0 days
Flint (trifloxystrobin)	Syngenta	12 hours	0 days	—	—
Fontelis (penthiopyrad)	DuPont	12 hours	0 days	—	0 days
Fracture	FMC	4 hours	1 day	—	—
Fungicides (cont.)					
Indar (fenbuconazole)	Dow AgroSciences	12 hours	—	30 days	30 days
Inspire Super (difenoconazole)	Syngenta	12 hours	0 Days	—	—
Kenja 400SC	ISK Biosciences	12 hours	0 days	—	0 days
Lime sulfur	various	48 hours	—	0 days	—
Luna Privilege	Bayer CropScience	12 hours	0 days (drip)	—	—
Merivon (pyraclostrobin & fluxapyroxad)	BASF	12 hours	0 day PHI for strawberry	not labelled	not labelled
MetaStar (metalaxyl)	LG life Science	48 hours	0 days	45 days	—
Mettle (tetraconazole)	Isagro USA	12 hours	0 days	—	0 days
Orbit (propiconazole)	Syngenta	24 hours	0 days	30 days	30 days
OSO 5SC	Certis U.S.A.	4 hours	0 days	0 days	0 days
PhD	Arysta LifeScience	4 hours	0 days	0 days	0 days
Phostrol	Nufarm Americas	4 hours	0 days	0 days	0 days
Procure	Chemtura	12 hours	1 day	—	—
Protocol	Loveland Products	24 hours	1 day	—	—
Pristine (pyraclostrobin & boscalid)	BASF	24 hours 12 hours (strawberries)	0 days	0 days	0 days
ProPhyt	Helena	4 hours	0 days	0 days	0 days

Table 2.7 - Chemical Names, Re-entry Intervals (REI) and Preharvest Intervals (PHI) (cont.)

			Preharvest Interval		
Chemical	**Manufacturer**	**Re-entry Interval**	**Strawberry**	**Caneberries**	**Blueberry**
PropiMax (propiconazole)	Dow AgroSciences	24 hours	—	30 days	30 days
Quadris Top (azoxystrobin & difenoconazole)	Syngenta	12 hours	0 days	—	—
QuiltXcel	Syngenta	12 hours	0 days	30 days	30 days
Rally (myclobutanil)	Dow AgroSciences	24 hours	0 days	0 days	—
Ridomil Gold	Syngenta	0 hours (soil-injected or incorporated applications) 48 hours (soil-directed or foliar sprays)	0 days 0 days	— 45 days	— 45 days
Rovral (iprodione)	Bayer CropScience	24 hours	prebloom	0 days	—
Scala	Bayer CropScience	12 hours	1 day	—	—
Switch (cyprodinil & fludioxonil)	Syngenta	12 hours	0 days	0 days	0 days
Tavano 5SC, (Polyoxin D zinc salt)	Certis U.S.A.	4 hours	0 hours PHI	0 hours PHI	0 hours PHI
Thiram	Taminco	24 hours	3 days	—	—
Tilt	Syngenta	12 hours	0 days	30 days	30 days
Topsin-M	United Phosphorus	12 hours	1 day	—	—
Torino (cyflufenamid)	Gowan	4 hours	0 days	—	0 days
Ultra FLourish	New Farm Americas	48 hours	0 days	45 days	0 days
Ziram	United Phosphorus, Taminco	48 hours	—	(see label)	(see label)
Insecticides					
Actara (thiamethoxam)	Sygenta	12 hours	3 days	3 days	3 days
Admire Pro (imidacloprid)	Bayer CropScience	12 hours	14 days (soil) 7 days (foliar)	7 days (soil) 3 days (foliar)	7 days (soil) 3 days (foliar)
Agri-Mek (abamectin)	Syngenta	12 hours	3 days	—	—
Altacor (chlorantraniliprole)	DuPont	4 hours	—	3 days	1 day
Asana (esfenvalerate)	DuPont	12 hours	—	7 days	14 days

Table 2.7 - Chemical Names, Re-entry Intervals (REI) and Preharvest Intervals (PHI) (cont.)

			Preharvest Interval		
Chemical	**Manufacturer**	**Re-entry Interval**	**Strawberry**	**Caneberries**	**Blueberry**
Assail (acetamiprid)	United Phosphorus	12 hours	1 day	1 day	1 day
Aza-Direct (azadirachtin)	Gowan	4 hours	0 days	0 days	0 days
Azera (azadirachtin and pyrethrins)	MGK	12 hours	0 days	0 days	0 days
Altacor (chlorantraniliprole)	Dupont	4 hours	—	3 days	1 day
Brigade (bifenthrin)	FMC	12 hours	0 days	3 days	1 day
Confirm (tebufenozide)	Gowan	4 hours	—	14 days	14 days
Danitol (fenpropathrin)	Valent	24 hours	2 days	3 days	3 days
Delegate (spinetoram)	Dow AgroSciences	4 hours	—	1 day	3 days
diazinon	Helena	3 days strawberries 5 days blueberries	5 days	—	7 days
Dipel	Valent	4 hours	0 days	0 days	0 days
Entrust (spinosad)	Dow AgroSciences	4 hours	1 day	1 day	3 days
Insecticides (cont.)					
Esteem (pyriproxyfen)	Valent	12 hours	—	—	7 days
Exirel (cyantraniliprole)	DuPont	12 hours	—	—	3 days
Imidan (phosmet)	Gowan	3 days	—	—	3 days
Intrepid (methoxyfenozide)	Dow AgroSciences	4 hours	—	—	7 days
Kanemite (acequinocyl)	Arysta LifeScience	12 hours	1 day	—	—
Lannate (methomyl)	DuPont	48 hours	—	—	3 days
Lorsban (chlorpyrifos)	Dow AgroSciences	24 hours	21 days	—	—
malathion	Gowan, UAP	12 hours	3 days	1 day	1 day
M-Pede (insecticidal soap)	Dow AgroSciences	12 hours	0 days	0 days	0 days
Mustang Max (zeta cypermethrin)	FMC	12 hours	—	1 day	1 day
Neemix (azadirachtin)	Certis	12 hours	0 days	0 days	0 days
PyGanic (pyrethrin)	MGK	12 hours	0 days	0 days	0 days
Radiant (spinetoram)	Dow AgroSciences	4 hours	1 day	—	—
Rimon (novaluron)	Chemtura	12 hours	1 day	—	8 days

Table 2.7 - Chemical Names, Re-entry Intervals (REI) and Preharvest Intervals (PHI) (cont.)

			Preharvest Interval		
Chemical	**Manufacturer**	**Re-entry Interval**	**Strawberry**	**Caneberries**	**Blueberry**
Sevin (carbaryl)	Bayer CropScience	12 hours	7 days	7 days	7 days
Sniper (bifenthrin)	Loveland Products	12 hours	—	3 days	1 day
Surround (kaolin)	Engelhard	4 hours	—	0 days	0 days
Thionex (endosulfan)	Makhteshimi Agan	7 days	7 days	—	—
Trilogy (clarified neem extract)	Certis	4 hours	0 days	0 days	0 days
Tri-Tek (oil)	Brandt	4 hours	0 days	0 days	0 days
Acaricides					
Acramite (bifenazate)	Chemtura	12 hours	1 day	1 day	non-bearing only
Brigade (bifenthrin)	FMC	12 hours	0 days	3 days	1 day
Kanemite (acequinocyl)	Arysta LifeScience	12 hours	1 day	1 day	1 day
Acaricides (cont.)					
Nealta (cyflumetofen)	BASF	12 hours	1 day	—	—
Oberon (spiromesifen)	Bayer CropScience	12 hours	3 days	—	3 days
Savey (hexythiazox)	Gowan	12 hours	3 days	3 days	3 days
Stylet Oil	JMS Flower Farms	4 hours	0 days	0 days	0 days
Vendex (fenbutatin oxide)	United Phosphorus	48 hours	1 day	—	—
Zeal (etoxazole)	Valent	12 hours	1 day	0 days	1 day

Commercial Small Fruit: Nematodes

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Table 2.8 - Preplant Fumigation: Blackberries, Blueberries, Raspberries, and Strawberries

Pests/Pathogens Controlled	Soil Fumigant Product	Broadcast Equivalent Rate/Acre	Remarks
Plant parasitic nematodes only	1,3-dichloropropene 94% (Telone II)	27.0-35.0 gal	Follow detailed label instructions carefully.
Certain soil fungi only	Chloropicrin	150-500 lb	Follow detailed label instructions carefully.
Plant parasitic nematodes and certain soil fungi	Methyl Bromide: chloropicrin 50:50	350-400 lb	Methyl bromide will probably not be available in 2016.
	1,3-dichloropropene, 65% + chloropicrin, 35% (Telone C-35)	39.0-50.0 gal or 437-560 lb	Also moderate nutsedge control when Telone C-35 is tarped with VIF.
	1,3-dichloropropene, 40% + chloropicrin, 60% (PicClor 60)	19.5-31.5 gal or 236.0-381.0 lb	Lower rates with VIF tarps have been associated with losses in weed control.
	Metam sodium 42% (Vapam HL, Sectagon, Metam CLR, etc.)	37.5-75.0 gal	Application methods for metam sodium and metam potassium products vary significantly depending on target pests and other factors. See labels for extensive, detailed instructions.
	Metam potassium (K-Pam HL)	37.2 gal	
Plant-parasitic nematodes & certain soil fungi	Allyl isothiocyanate or AITC (Dominus)	25-40 gal (213-340 lb)	Limited experience with this recently registered product; 10-day plant back interval. AITC is chemically-related to metam products, so may perform similarly against a similar range of target pests.
	Dimethyl disulfide (Paladin) should be formulated with 21% chloropicrin.	35.0-51.3 gal	Paladin can provide good nutsedge control, but poor control of certain small-seeded broadleaf weeds and grasses.
	Dazomet 99% (Basamid G)		Dazomet is registered for “non-bearing food crops”. Use only for crops due to be harvested no sooner than 1 year after planting. Follow detailed label instructions for each product carefully.

CAUTION: Vapors from fumigants are toxic. **Read the label completely and follow directions strictly.**

Methyl bromide and the soil fumigant “Midas” are no longer available for purchase, although growers may apply product already in hand. Small fruit growers should select a soil fumigant product based on the types of soil pathogens and pests present in their field(s). Soil assays for plant-parasitic nematode populations should indicate the need for a nematode control product. Products containing 1,3-dichloropropene do so in order to control nematodes, while the chloropicrin, metam sodium, metam potassium, or AITC are included primarily to control fungal pathogens and weed seeds. All soil fumigants are restricted use pesticides, with all the associated requirements, including respirator fit-testing, mandated use of full-face respirators for many soil fumigants, written “fumigant management plans” (FMPs), restrictions on cutting and removal of tarps, air monitoring in special circumstances, posting of treated fields and buffer zones surrounding treated fields, and 3-day “entry restricted periods (ERPs)”. FMPs must be completed *before* application, and include documenting the site(s) to be fumigated, handler information, compliance with mandatory good agricultural practices (GAPs), as well as weather conditions surrounding soil fumigation. A “post-application summary” must also be completed for each fumigation. FMPs

and post-application summaries must be maintained for 2 years. Most soil fumigant labels also now include minimum distances between treated fields and sites that would be difficult to evacuate (schools, etc.) and official notification requirements.

Growers who fumigate soil or contract with others to fumigate their fields need to familiarize themselves with all new requirements. **Fumigant applicators must be certified by the Virginia Department of Agriculture and Consumer Services in order to purchase soil fumigants from their dealer. Certifications are valid for a 3 year period. Certification programs will be conducted again in 2016 for applicators to renew their certification. Applicators should check for the dates, times and locations of these programs.**

The mandatory GAPs included in the new soil fumigant labels document practices long recommended for soil fumigant application. Prior to fumigation, soil should be cultivated deeply and thoroughly, breaking up all clods and crop debris so that the area to be gassed is in good "seed bed" condition and as free as possible of un-decayed organic matter. *Adequate soil moisture and soil temperatures at the depth of injection between 50º and 80ºF are critical to effective soil fumigation.* Fumigation characteristics vary significantly among soil fumigants, so check product labels for specific directions regarding shank spacing and outlet depth for specific products and target pests. For example, shank spacing is often narrower and outlet depth shallower for application of metam sodium products. Soil should be smoothed and compacted and/or covered with plastic mulch immediately after use of all soil fumigants in order to minimize gas escape.

Broadcast fumigation may provide more lengthy nematode control when the crop to be planted will be maintained for multiple years, but the "in-row" fumigation common in annual strawberry plasticulture typically provides excellent control over a single growing season using less total fumigant, because less soil is actually treated. The amount of product needed for in-row fumigation is calculated based upon the area treated relative to the total area of land devoted to the crop. *Important note: the area to be fumigated is based on the width of the "bed" at the bottom versus the top.* VIF (virtually impermeable film) and TIF (totally impermeable film) plastic mulches that increase fumigant activity and reduce fumigant emissions into the atmosphere. Using VIF or TIF mulches may enable applicators to reduce the fumigant rates, sometimes reducing the size of buffer zones, but these reductions can also reduce fumigant effectiveness for some products and target pests. Formulations of soil fumigants are also now available that enable application of these products through drip-lines, similar to in-row fumigation. Be sure to read, understand, and follow instructions in these labels carefully.

Because fumigant residues can severely damage new plantings, a waiting period is required for all soil fumigants, but broadcast soil fumigation for perennial crops is typically timed in the fall to allow at least a 4 to 8 week "waiting period" to allow the fumigant to dissipate from treated soil. Waiting periods vary for different fumigants and are also highly influenced by environmental conditions. Check fumigant labels for recommended procedures to ensure fumigant residues have dissipated sufficiently to avoid crop injury.

Commercial Small Fruit: Weeds

Jeffrey F. Derr, Extension Weed Scientist, Hampton Roads AREC

Table 2.9 - Herbicides

Crop	Weeds Controlled	Chemical Rate/A (Product/A)	Remarks
Preemergence directed			
Blueberries, Blackberries, and Raspberries	Most annuals, fescue, quackgrass, dandelions, dock, and other herbaceous perennials	dichlobenil 4.0-6.0 lb (Casoron 4G 100.0-150.0 lb or 2.3-3.4 lb/1000 sq ft)	Apply dry granules in late winter or early spring. Shallow incorporation may improve weed control. Do not apply within 4 weeks after transplanting. Short residual activity; regrowth usually occurs in late summer. Do not graze livestock in treated areas. Do not make application within one month of harvest. Do not apply over 4.0 lb of dichlobenil to blackberries or raspberries and do not apply during new shoot emergence.
	Annual grasses and broadleaf weeds	flumioxazin 0.19-0.375 lb (Chateau 51WDG 6.0-12.0 oz)	For blueberries only. Do not apply to blueberries established less than 2 years unless stems are protected by grow tubes, wraps, or waxed containers. Do not apply after budbreak through final harvest. Avoid contact with foliage and green bark.
	Annual broadleaf and certain annual grassy weeds	mesotrione 0.09-0.18 lb (Callisto 3.0-6.0 fl oz)	Blueberries only. Apply preemergence or early postemergence. For improved postemergence control, apply 3.0 fl oz Callisto followed 3 weeks later by a second application at that rate. Apply prior to bloom. Include a crop oil concentrate tolerated by blueberries if applied postemergence to weeds.
	Annual grasses and certain broadleaf weeds	napropamide 4.0 lb (Devrinol 50DF 8.0 lb)	Apply to a weed-free surface or include an appropriate postemergence herbicide. May be applied to newly planted and established crop. Must be incorporated by rainfall or irrigation within 24 hours of application for optimum results. May be tank-mixed with other herbicides for broader-spectrum weed control.
	Annual grasses, certain broadleaf weeds, and suppression of perennial grasses and nutsedge	norflurazon 2.0-4.0 lb (Solicam DF 2.5-5.0 lb)	Apply only to blueberries established at least 6 months and to raspberries and blackberries established at least 12 months. Apply when crop is dormant. Apply to weed-free soil or include an appropriate postemergence herbicide. Combine with simazine for improved broadleaf control.
	Annual grasses and certain broadleaf weeds	oryzalin 2.0-6.0 lb (Surflan 4AS 2.0-6.0 qt, Oryzalin 4AS 2.0-6.0 qt)	May be used immediately after planting or in established plantings. Apply to weed-free soil or include an appropriate postemergence herbicide. Use lowest rate for short-term control, 4.0 lb for full-season control, and the highest rate for long-term (8–12 months) control. May be tank-mixed with such herbicides as simazine or terbacil to control a broader spectrum of weeds in established plantings.
	Annual grasses and broadleaf weeds	simazine 2.0-4.0 lb (Princep 4L 2.0-4.0 qt)	Apply to weed-free soil or include an appropriate postemergence herbicide. Split application possible with 1/2 rate in fall and 1/2 rate in spring. On plantings less than 6 months old use 1/2 the total rate of application.

Table 2.9 - Herbicides (cont.)

Crop	Weeds Controlled	Chemical Rate/A (Product/A)	Remarks
	Annual grasses and broadleaf weeds plus some perennial broadleaf weeds	terbacil 0.8-1.6 lb (Sinbar WDG 1.0-2.0 lb)	Only treat plantings established for one year or more. Use higher rate on heavy (clay) soils with high organic matter (3% +). May be applied in early spring or late fall.
Postemergence directed			
Blueberries, Blackberries, and Raspberries	Annual broadleaf weeds	carfentrazone-ethyl 0.016-0.031 lb (Aim 2EC, 1.9 EW 1.0-2.0 fl oz/A)	Apply post-directed using a hooded sprayer for control of small annual broadleaf weeds less than 4 inches tall. Add a crop-oil concentrate or nonionic surfactant. Can be tank mixed with other herbicides for broader-spectrum weed control. Can also be used for control of primocanes – see label rates and directions for this use.
	Annual and perennial grasses	clethodim 0.09-0.12 lb Select 2EC 6.0-8.0 fl oz or Select Max 9.0-16.0 fl oz + 0.25% v/v nonionic surfactant)	Apply to actively growing grasses. Will control annual bluegrass. For spot treatment, use 0.33-0.65 fl oz Select 2EC or 0.44-0.88 fl oz Select Max per gallon plus 0.33 fl oz nonionic surfactant. A repeat application may be required for perennial grass control. Can only be used on nonbearing plants. Allow at least one year between application and harvest. The preharvest interval for Select Max is blueberry 14 days and caneberries 7 days.
	Annual and perennial grasses	fluazifop-P-butyl 0.25-0.375 lb (Fusilade DX 16.0-24.0 fl oz + 2 pt crop oil concentrate or 1/2 pt nonionic surfactant/25.0 gal)	Use a directed spray on actively growing grasses. Treat annual grasses before tillering for optimum results. Perennial grasses may need repeat treatment for total control. Do not treat canes to be harvested within one year of application. For spot treatment use 0.75 oz Fusilade DX plus 1.5 fl oz crop-oil concentrate or 0.5 fl oz nonionic surfactant/gal.
	Annual and perennial weeds	glufosinate 0.88-1.5 lb (Rely 280 48.0-82.0 fl oz)	Blueberries only. Apply as a directed spray, keeping droplets off blueberry foliage and stems. Repeat application may be needed for perennial weed control. Do not apply within 14 days of harvest. For spot application apply 1.7 fl oz Rely 280/gal.
	Annual and perennial grasses and broadleaf weeds	glyphosate 0.75-3.75 lb ae (Roundup UltraMax 26.0 fl oz-4 qt, Touchdown 1.0-5.0 qt, or other labeled formulation. For wiper application use 1 part Roundup to 4 parts water)	Can be applied prior to planting or to control emerged weeds after planting. Avoid contacting leaves or stems of crop plants or systemic injury could occur. For spot treatment use 2.0 fl oz Roundup UltraMax or Touchdown/gal and spray to wet. Other glyphosate formulations are available. Check the label for appropriate rates.
	Annual weeds, contact activity only, will not control established perennial weeds	paraquat 0.5-1.0 lb (Gramoxone Inteon 2.0-4.0 pt/A + 1.0-2.0 pt nonionic surfactant/100 gal water)	Apply as coarse directed spray to thoroughly wet emerged weeds. Apply before emergence of new crop shoots. Do not allow spray to contact new shoots or green stems, otherwise injury is likely. **RESTRICTED USE PESTICIDE**
	Annual and perennial grasses	sethoxydim 0.28-0.47 lb ai (Poast 1.5-2.5 pt + 1.0 qt crop-oil concentrate)	Do not apply within 45 days of harvest in raspberries and blackberries or within 30 days of harvesting blueberries. Apply in a minimum of 10 gal/A of water. Apply the lower rate to annual grasses up to 6 inches tall and apply higher rate to annual grasses up to 12 inches tall and to perennial grasses. For spot treatment, use 1.25 fl oz Poast plus 1.25 fl oz crop-oil concentrate/gal.

Table 2.9 - Herbicides (cont.)

Crop	Weeds Controlled	Chemical Rate/A (Product/A)	Remarks
	Yellow nutsedge and certain broadleaf weeds	halosulfuron 0.036-0.047 lb (Sandea 0.75-1.0 oz nonionic surfactant 0.25% V/V)	Apply only to highbush blueberry. 14-day preharvest interval. Plants need to be established at least one year and keep the spray off the blueberry foliage. Treat when yellow nutsedge is actively growing under good soil moisture.
Strawberries	Annual and perennial grasses	clethodim 0.09-0.125 lb (Select 2EC 6.0-8.0 fl oz + 1% crop-oil concentrate or Select Max 9.0-16.0 fl oz + 0.25% nonionic surfactant)	Apply to actively growing grasses. Will control annual bluegrass. For spot treatment, use 0.33-0.65 fl oz Select 2EC or 0.44-0.88 fl oz Select Max per gallon plus 0.33 fl oz nonionic surfactant. A repeat application may be required for perennial grass control. Allow at least 4 days between application and harvest.
	Certain annual and perennial broadleaves	clopyralid 0.12-0.25 lb (Stinger 0.33-0.67 pt/A)	Apply to actively-growing broadleaf weeds. Primarily controls weeds in the legume and composite families. Stinger can be applied to strawberries at 0.33 pt/A in spring. Do not apply within 30 days of harvest. Up to 0.67 pt/A can be used after harvest. Growers who intend to use the product in strawberries must sign a waiver of liability.
	Annual broadleaf weeds	carfentrazone-ethyl 0.006-0.025 lb (Aim 40DF 0.33-1.0 oz, Aim 1.9EW or 2EC 0.5-1.6 fl oz)	Apply post-directed using a hooded sprayer for control of small annual broadleaf weeds less than 4 inches tall. Add a crop-oil concentrate or nonionic surfactant between the rows in plasticulture. Can be tank mixed with other herbicides for broader-spectrum weed control.
	Annual grasses and broadleaf weeds	flumioxazin 0.09 lb (Chateau WDG 3.0 oz/A)	Apply before laying plastic to formed beds at least 30 days before transplanting. Apply to dormant strawberries for preemergence weed control. Addition of a crop-oil concentrate or nonionic surfactant may improve postemergence weed control. Can be applied using a hooded or shielded spray to row middles prior to fruit set. Do not apply overtop of strawberries. Dormant applications can be made to plants in the matted row production system.
	Annual grasses and certain broadleaf weeds	DCPA 6.0-9.0 lb (Dacthal W-75 8.0-12.0 lbs/A)	Can be used in new and established plantings. Apply prior to weed germination. Do not apply after first bloom through harvest in the matted row production system.
	Annual grasses and certain broadleaf weeds	napropamide 4.0 lb (Devrinol 50 DF 8.0 lb)	Use on established strawberries. Delay application until daughter plants in the desired number have become established in the matted row production system. Do not apply from bloom to harvest. Make only one application/season. Does not control established weeds. Apply in fall through early winter. Early spring applications may also be made, but rainfall or irrigation will be needed for optimum weed control. Can also be applied to row middles in plasticulture production systems.

Table 2.9 - Herbicides (cont.)

Crop	Weeds Controlled	Chemical Rate/A (Product/A)	Remarks
	Annual broadleaf weeds	oxyfluorfen 0.25-0.5 lb (Goal 2XL 1.0-2.0 pt)	Apply to the surface of preformed fallow beds at least 30 days prior to transplanting strawberries. Incorporation prior to planting reduces the potential for crop injury. Plastic mulch can be applied anytime after application but, ideally, soon after the Goal was applied.

Table 2.9 - Herbicides (cont.)

Crop	Weeds Controlled	Chemical Rate/A (Product/A)	Remarks
Strawberries (cont.)	Annual weeds	acifluorfen 0.25-0.375 lb (UltraBlazer 1.0-1.5 pt)	Apply prior to laying laying plastic and transplanting. Can also be applied to row middles as a shielded directed spray. Do not allow spray to contact strawberry plants. Apply after last harvest or following bed renovation in matted row production. Can also be applied in late fall or winter when plants are dormant in matted row production. Do not apply the last application within 120 days before harvest.
	Annual weeds and suppression of perennials	paraquat 0.5 lbs (Gramoxone Inteon 2.0 pt)	Directed spray to row middles using a shielded spray. Do not allow spray to contact strawberry plants. Do not apply within 21 days of harvest.
	Annual and perennial grasses	sethoxydim 0.28-0.47 lb ai (Poast 1.5-2.5 pt + 1.0 qt crop-oil concentrate)	Do not apply within 7 days of harvest. Apply the lower rate to annual grasses up to 6 inches tall. Apply higher rate to taller annual grasses and perennial grasses. For spot treatment use 1.25 fl oz Poast plus 1.25 fl oz crop-oil concentrate/gal. Do not tank mix with other pesticides.
	Annual broadleaf weeds	2,4-D amine 1.0-1.5 lb (Formula 40 1.0-1.5 qt)	Apply to established beds in late winter when the strawberries are dormant or immediately after last picking 7 to 10 days before renovation in matted row production. Do not apply during bud, flower, or fruit stage, or during runner formation. Do not apply unless some injury is acceptable.
	Annual grasses and broadleaf weeds	terbacil 0.1-0.3 lb (Sinbar WDG 2-6 ounces/A)	Use only on plants established at least 6 months in a matted row production system. Apply after postharvest renovation before new growth begins or in late fall to control winter annuals. Do not apply more than 8.0 oz of Sinbar/A/ growing season. Do not use on soils less than 2% organic matter.

Table 2.10 - Relative Effectiveness of Preemergence Herbicides in Small Fruit

	Dichlobenil	DCPA	Flumioxazin	Mesotrione	Napropamide	Norflurazon	Oryzalin	Oxyfluorfen	Simazine	Terbacil
Annual Grasses										
Barnyardgrass	G	G	F	P	G	E	G	F	F-G	G
Cheat	G	-	-	-	G	G	G	-	G	G
Crabgrass	G	G	F-G	F	E	E	E	F	F-G	F-G
Fall panicum	F	G	F	P	G	E	G	-	F-G	G
Foxtails	G	G	F-G	P	E	E	E	F	G	G
Goosegrass	F	G	F-G	P-F	E	G	E	F	E	-

(E=Excellent ; G=Good ; F=Fair ; P=Poor; N=None; –=Unknown)

Table 2.10 - Relative Effectiveness of Preemergence Herbicides in Small Fruit (cont.)

	Dichlobenil	DCPA	Flumioxazin	Mesotrione	Napropamide	Norflurazon	Oryzalin	Oxyfluorfen	Simazine	Terbacil
Johnsongrass (seedling)	F	-	P-F	N	P	G	F-G	-	N	-
Annual Broadleaf Weeds										
Annual fleabane	E	-	-	-	G	F	G	G	G	E
Annual morningglory	G	N	F-G	F	N	F	P-F	F	E	G
Black nightshade	G	N	G	P	N	F-G	P-F	G	E	-
Carpetweed	G	F	G	-	G	G	G	G	E	E
Common chickweed	G	G	-	-	G	G	G	G	E	G
Common lambsquarter	G	G	F-G	G	F-G	G-E	G	G	E	G
Common ragweed	G	N	G	P	F	F	P	F	E	G
Hairy galinsoga	G	N	-	G	G	-	P	G	E	E
Henbit	G	-	G	G	F	-	G	G	E	G
Horseweed	G	-	G	-	P	G	F	F	E	G
Knotweed	G	-	-	-	G	F	G	G	E	G
Mustards	G	P	-	-	P	F	P-F	G	G	E
Pennsylvania smartweed	G	N	-	-	P	-	P-F	G	E	G
Pigweeds	G	F	G	F-G	G	F	G	G	E	G
Prickly lettuce	G	-	-	-	G	-	F	G	E	G
Prickly sida	F-G	-	G	-	N	P	P-F	G	G	-
Purslane	G	G	-	-	G	G	G	G	E	E
Shepherds' purse	G	P	-	-	F	G	G	G	E	G
Speedwells	-	G	-	G	-	-	-	-	-	
Velvetleaf	-	N	G	-	N	F	P-F	F	G	G
Virginia pepperweed	G	-	-	-	F	G	G	-	E	-
Perennial Grasses And Sedges										
Bermudagrass	N	N	N	P	N	P	N	N	N	F
Dallisgrass	-	N	N	P	N	P	N	N	N	F-G
Fescues	G	N	N	N	N	F	N	N	P	F
Johnsongrass (rhizome)	-	N	N	N	N	P	N	N	N	P
Nimblewill	-	N	N	F-G	N	F	N	N	P	P
Orchardgrass	G	N	N	-	N	F	N	N	P-F	G-E
Perennial Grasses And Sedges (cont.)										
Purpletop, Redtop	-	N	N	-	N	F-G	N	N	N	F-G
Quackgrass	G	N	N	-	N	P	N	N	P-F	G
Yellow nutsedge	P-F	N	N	F	P	P-F	N	N	N	F-G
Perennial Broadleaf Weeds										

(E=Excellent ; G=Good ; F=Fair ; P=Poor; N=None; –=Unknown)

Table 2.10 - Relative Effectiveness of Preemergence Herbicides in Small Fruit (cont.)

	Dichlobenil	DCPA	Flumioxazin	Mesotrione	Napropamide	Norflurazon	Oryzalin	Oxyfluorfen	Simazine	Terbacil
Broadleaf plantain	G	N	-	-	N	P	N	N	G	F
Buckhorn plantain	G	N	-	-	N	P	N	N	G	F
Canada thistle	P-F	N	-	-	N	N	N	N	N	N
Chicory	G	N	-	-	N	N	N	N	P-F	G
Common dandelion	E	N	-	-	N	N	N	N	P-F	G-E
Common mallow	G	N	-	-	N	N	N	N	N	-
Common milkweed	-	N	-	-	N	N	N	N	N	N
Common yarrow	-	N	-	-	N	N	N	N	-	N
Docks (broadleaf, curly)	G	N	-	-	N	N	N	N	N	F
Goldenrod	F-G	N	-	-	N	N	N	N	N	P-F
Ground ivy	E	N	-	-	N	N	N	N	N	N
Hemp dogbane	N	N	-	-	N	N	N	N	N	N
Horsenettle	N	N	-	-	N	N	N	N	P	F-G
Mugwort	G-E	N	-	-	N	N	N	N	N	P
Red sorrel	G	N	-	-	N	N	N	N	N	P
Thistles (bull, musk, curly)	F	N	-	-	N	N	-	N	-	-
White flowered aster	G	N	-	-	N	N	N	N	N	N
Wild carrot	G	N	-	-	N	F	N	N	N	F
Wild strawberry	G	N	-	-	N	P	N	N	N	N
Yellow rocket	G	N	—	—	N	F	N	N	P	G
Yellow woodsorrel (from seed)	G	G	—	—	P	F	F	N	F	G
Special Perennial Weed Problems										
Bigroot morningglory	N	N	—	—	N	N	N	N	N	N
Brambles (Rubus spp.)	N	N	—	—	N	N	N	N	N	N
Common greenbriar	N	N	—	—	N	N	N	N	N	N
Japanese honeysuckle	N	N	—	—	N	N	N	N	N	N
Poison ivy	N	N	—	—	N	N	N	N	N	N
Virginia creeper	N	N	—	—	N	N	N	N	N	N
Wild garlic	F	N	—	—	N	N	N	N	N	N

(E=Excellent ; G=Good ; F=Fair ; P=Poor; N=None; –=Unknown)

Table 2.11 - Relative Effectiveness of Postemergence Herbicides in Small Fruit

(E=Excellent; G=Good; F=Fair; P=Poor; N=None; –=Unknown)

Table 2.11 - Relative Effectiveness of Postemergence Herbicides in Small Fruit (cont.)

	Acifluorfen	Carfentrazone	Fluazifopbutyl	Glyphosate	Sethoxydim	2,4-D	Clopyralid	Paraquat	Clethodim
	Acifluorfen	Carfentrazone	Fluazifopbutyl	Glyphosate	Sethoxydim	2,4-D	Clopyralid	Paraquat	Clethodim
Annual Grasses									
Barnyardgrass	N	N	E	E	E	N	N	G	E
Cheat	—	—	G	E	G	N	N	G	-
Crabgrass	N	N	E	E	E	N	N	G	E
Fall panicum	P	N	E	E	E	N	N	G	E
Foxtails	P	N	E	E	E	N	N	G	E
Goosegrass	N	N	E	E	E	N	N	G	E
Johnsongrass (seedling)	P	N	E	E	E	N	N	G	E
Annual Broadleaf Weeds									
Annual fleabane	—	—	N	E	N	G	—	E	N
Annual morningglory	G-E	F	N	E	N	E	N	G	N
Black nightshade	F-G	G	N	E	N	F-G	F	G	N
Carpetweed	—	G	N	E	N	E	—	E	N
Common chickweed	—	F	N	E	N	P	—	E	N
Common lambsquarter	P-F	G	N	E	N	G	P	E	N
Common ragweed	E	P	N	E	N	G	E	E	N
Hairy galinsoga	—	—	N	E	N	G	—	E	N
Henbit	—	G	N	E	N	G	—	E	N
Horseweed	—	—	N	E	N	G	G	G	N
Knotweed	—	—	N	E	N	F	—	F	N
Mustards	—	—	N	E	N	G	—	F	N
Pennsylvania smartweed	G	—	N	E	N	P	F	G	N
Pigweeds	G-E	G	N	E	N	G	P	G	N
Prickly lettuce	—	—	N	E	N	P	—	G	N
Prickly sida	N	—	N	E	N	G	—	E	N
Purslane	—	—	N	E	N	F	—	G	N
Shepherds' purse	—	—	N	E	N	G	—	G	N
Speedwells	—	G	N	E	N	P	—	P	N
Velvetleaf	P	E	N	E	N	G	P	E	N
Virginia pepperweed	—	—	N	E	N	G	—	G	N
Perennial Grasses And Sedges									
Bermudagrass	—	N	G	G	G	N	N	P	G
Dallisgrass	—	N	G	E	G	N	N	P	—
Fescues	—	N	P-F	E	P-F	N	N	F	F

(E=Excellent; G=Good; F=Fair; P=Poor; N=None; –=Unknown)

Table 2.11 - Relative Effectiveness of Postemergence Herbicides in Small Fruit (cont.)

	Acifluorfen	Carfentrazone	Fluazifopbutyl	Glyphosate	Sethoxydim	2,4-D	Clopyralid	Paraquat	Clethodim
Johnsongrass (rhizome)	—	N	G	E	G	N	N	P	G
Nimblewill	—	N	G	G-E	F-G	N	N	P	—
Perennial Grasses And Sedges (cont.)									
Orchardgrass	—	N	F	E	F	N	N	F	F
Purpletop, Redtop	—	N	G	E	G	N	N	P	—
Quackgrass	—	N	G	G	G	N	N	P	G
Yellow nutsedge	—	N	N	G	N	N	N	P	N
Perennial Broadleaf Weeds									
Broadleaf plantain	—	—	N	E	N	G	—	P	N
Buckhorn plantain	—	P	N	E	N	G	P	P	N
Canada thistle	—	—	N	F-G	N	F-G	G	P	N
Chicory	—	—	N	E	N	G	—	P	N
Common dandelion	—	P	N	E	N	G	F	P	N
Common mallow	—	—	N	E	N	—	—	P	N
Common milkweed	—	—	N	G	N	P-F	—	P	N
Common yarrow	—	—	N	G	N	F	—	P	N
Docks (broadleaf, curly)	—	P	N	G	N	G	—	P	N
Goldenrod	—	—	N	E	N	P-F	—	P	N
Ground ivy	—	—	N	G	N	P-F	—	P	N
Hemp dogbane	—	—	N	F	N	P-F	—	P	N
Horsenettle	—	—	N	F-G	N	P	—	P	N
Mugwort	—	—	N	F	N	P	P-F	P	N
Red sorrel	—	—	N	G	N	P	—	P	N
Thistles (bull, musk, curly)	—	—	N	G	N	F-G	G	P	N
White flowered aster	—	—	N	E	N	N	—	P	N
Wild carrot	—	—	N	E	N	P-F	—	P	N
Wild strawberry	—	—	N	E	N	P-F	—	P	N
Yellow rocket	—	—	N	E	N	P-F	—	P	N
Yellow woodsorrel	—	—	N	E	N	F	N	P	N
Special Perennial Weed Problems									
Bigroot morningglory	—	—	N	F-G	N	F-G	—	P	N
Brambles (*Rubus* spp.)	—	—	N	G	N	P	—	P	N
Common greenbriar	—	—	N	P	N	N	—	P	N
Japanese honeysuckle	—	—	N	F-G	N	P-F	—	P	N
Poison ivy	—	—	N	G	N	F	—	P	N
Virginia creeper	—	—	N	F-G	N	F	—	P	N
Wild garlic	—	—	N	F	N	F	—	P	N

(E=Excellent; G=Good; F=Fair; P=Poor; N=None; –=Unknown)