

Eco Stone Fruit Supplement

Participating Growers Must Also Complete Core Eco Protocol

Deadline for record submission: July 5, 2019

2019 growing season v. 2.4 – 03/22/2019

See Page 25 for list of revisions to this edition.

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Download the Most Recent Protocol at www.ipminstitute.org/ecoapple.htm

A. Minimum Requirements	Pass, Fail or N/A
<p>1. Brown rot (blossom blight)</p> <p>a. Cultural controls are used, e.g., removal of thinned fruit, infected twigs, mummified fruit and all fruit at harvest. ^S</p> <p>b. Fungicides are rotated to different modes of action between sprays to prevent brown rot resistance. ^D</p> <p>c. Brown rot infections and mummies are scouted and monitored throughout the growing season. ^D</p> <p>Note: Brown rot resistance to Indar (fenbuconazole) has been documented in New York. Using the same fungicide classes should be avoided for controlling both blossom blight and fruit rots.</p>	
<p>2. Western flower thrips</p> <p>a. Chemical control of thrips is determined from monitoring data. Monitoring should occur from pink through shuck fall. The action threshold is presence of thrips on 10% of fruit samples. ^D</p>	
<p>3. Peach scab</p> <p>a. Peaches are monitored for scab lesions from bloom through mid-July in blocks with a history of scab. Scab spores overwinter on shoots and monitoring is very important to determine presence of infections. If scab is found on fruit it will quickly spread unless appropriate treatments are made. ^D</p>	
<p>4. Green peach aphid (GPA)</p> <p>a. Chemical control of GPA is based on monitoring and thresholds. Monitor for GPA from petal fall to one month after shuck fall. ^D</p> <p>Note for peaches: Thresholds are an average of two or more colonies per tree between petal fall and shuck split and five or more colonies by late May.</p> <p>Note for nectarines: Threshold is one colony per tree at any given time on bearing trees.</p>	
<p>5. Japanese beetle</p> <p>a. Chemical control for Japanese beetle is not applied unless feeding injury to leaves or fruit is observed. Japanese beetle should be monitored from late summer through early fall. ^D</p> <p>Note: Control of Japanese beetle damage is important to minimize opportunity for brown rot infection from fruit feeding.</p>	

Superscripts indicates practice-verification process. Reference the following throughout entire document:

^D Verified during desk audit via submitted paperwork

^S Verified during site audit

A. Minimum Requirements	Pass, Fail or N/A
<p>6. Greater peachtree borer (GPTB) and lesser peachtree borer (LPTB)</p> <p>a. Pheromone traps are used to monitor GPTB and LPTB. ^D</p> <p>Note: Trap catches with ten or more moths per week warrant control, or the presence of one or two larva or pupal casings per tree from scouting. Pheromone lures for GPTB are not pest-specific and other clear-wing moths, e.g., dogwood borer and lilac borer, may be caught in traps. Pheromone lures for LPTB are pest-specific.</p>	
<p>7. Bacterial spot</p> <p>a. Use one or more copper applications during the fall and/or spring to reduce bacterial spot inoculum in susceptible varieties with a history of or potential for bacterial spot. ^D</p> <p>b. Control of bacterial spot after petal fall is determined by monitoring for lesions on fruit and leaves and weather data indicating wetting periods favorable for bacterial spot infections. ^D</p> <p>Note: Control of bacterial spot must be achieved preventatively through use of a protectant spray program.</p>	
<p>8. X-Disease</p> <p>a. Broadleaf weeds, if present in blocks with varieties susceptible to X-disease are controlled either through herbicide use or cultural controls, e.g., mechanical cultivators, mowing or mulching. ^D</p> <p>Note: Broadleaf weeds harbor leafhoppers which are X-disease vectors.</p>	
<p>9. Black knot – Plums</p> <p>a. Monitor for black knots on vegetative terminal shoots from dormancy through bloom. ^D</p> <p>b. Prune infected shoots and limbs during dormancy. Prunings are destroyed, e.g., burned or buried, to eliminate inoculum. ^S</p> <p>c. Chemical control of black knot is applied between white bud and shuck split, if justified by monitoring results. ^D</p>	
<p>10. Perennial canker (Also called Valsa, Cytospora, Leucostoma canker)</p> <p>a. Cultural controls are used to prevent infections, e.g., maintaining wide branch angles, removing infected cankers during dormancy, removing wild hosts and abandoned fruit trees. ^S</p> <p>b. Insects and diseases (greater and lesser peachtree borers, brown rot, etc.) that serve as vectors of perennial canker are managed effectively. ^S</p>	

A. Minimum Requirements	Pass, Fail or N/A
<p>11. Powdery mildew</p> <p>a. Control decisions are determined by scouting for the presence of white mycelial growth on young leaves. Fungicides, if needed, are applied between petal fall through pit hardening. Once fruit have reached pit-hardening stage, susceptible cultivars become resistant. ^D</p> <p>b. Application of chemical controls end once pit-hardening stage is reached and all cultivars become resistant. ^D</p>	
<p>12. Peach leaf curl</p> <p>a. If justified by monitoring, cultivar susceptibility and/or block history, chemical control for peach leaf curl is applied in the fall after 90% foliage drop or in the spring before bud swell. ^D</p> <p>b. Monitor young leaves during bloom for foliar symptoms of peach leaf curl. Monitoring should be done to determine effectiveness of chemical control and determine necessity of fall or spring pesticide application. ^D</p> <p>Note: Treatments for peach leaf curl are not effective once symptoms are present.</p>	
<p>13. Plum curculio</p> <p>a. After the first application of pesticide for plum curculio at or after shuck split, further treatment decisions are based on sampling fruit for any sign of fresh injury, fruit diameter reaching 6-7 mm and/or a degree-day-based oviposition model. The risk for plum curculio immigration into peach orchards likely ends at 350-degree days (base 50°F) from peach shuck split. ^D</p> <p>Note: Peach shuck split and McIntosh petal fall occur at approximately the same time in most regions of New York and New England. Accumulation of about 308-degree days (base 50°F) from McIntosh petal fall typically signals the end of plum curculio movement from overwintering sites into orchards.</p> <p>b. Second pesticide applications for plum curculio (and third if necessary) are perimeter-row sprays rather than whole-block treatments. ^D <i>You may score as NA where full-block applications may be needed including blocks with trees less than 7 feet in height, or where scouting indicates fresh injury in the interior of a block.</i></p>	

A. Minimum Requirements	Pass, Fail or N/A
<p>14. Mites</p> <p>a. Post-bloom miticides are applied only after mites and mite predators have been systematically sampled in each block and predators are insufficient to provide control. Systematic sampling includes viewing a pre-determined number of leaves and trees in each block and using a quantitative threshold for determining need to treat such as those found in the <i>New England Tree Fruit Management Guide</i>, the <i>Cornell Pest Management Guidelines for Commercial Tree Fruit Production</i> or the <i>Pennsylvania Tree Fruit Production Guide</i>.^D</p> <p>b. No more than two post-bloom applications of miticide are made per season.^D</p>	
<p>15. Oriental fruit moth and lesser appleworm</p> <p>a. Oriental fruit moth and/or lesser appleworm are not treated unless need is indicated by block or region history of economic injury or by monitoring using pheromone traps or sampling for damage.^D</p> <p>b. If oriental fruit moth and/or lesser appleworm are treated, degree days are used to calculate treatment timing.^D</p> <p>Note: Where a larvacide is used, the first treatment is applied at 150-200 degree days (base 45°F) after the first-sustained flight (biofix) of first generation oriental fruit moth. Second and third generation oriental fruit moth may be controlled at 1150-1200 and then 2100-2200 degree days from biofix. If pressure is severe, as indicated by pheromone traps or fruit damage, additional applications may be applied 10-14 days later. The threshold for oriental fruit moth is 15 moths per week during first generation and ten moths per week during second and third generation. <i>Score as NA if no treatments are made for oriental fruit moth or lesser appleworm.</i></p>	
<p>16. Tarnished plant bug and native stink bugs</p> <p>a. Treatments for tarnished plant bug and native stink bugs are based on scouting and thresholds where available.^D</p> <p>b. Orchard floor is managed to control tarnished plant bug and stinkbugs, e.g., mow after insecticide applications and control broad-leaf weeds with mowing or herbicides.^S</p> <p>Note: See page seven for brown marmorated stink bug. Sample for populations of tarnished plant bug and stink bugs between petal fall and shuck fall. White sticky boards have minimal success in peach orchards. Sample 100 to 200 fruit per block for feeding injury. Suggested action threshold: At pink, three bleeding sites per tree by late pink stage; at petal fall, three bleeding sites/tree; or 1-2% of fruit with new injury.</p>	

A. Minimum Requirements	Pass, Fail or N/A								
<p>17. Apple maggot – Plums</p> <p>a. Treatment decisions for apple maggot are based on monitoring with three or more red sphere traps per 10-15 acre block and a threshold of an average of one per trap if using unbaited traps or an average of five per trap if using odor-baited traps. Use more traps per acre in small blocks and other blocks with lengthy perimeters vs. area. At the end of the effective period of the pesticide, clean traps and continue to monitor. ^D</p> <p>Table A. Apple maggot degree-day model for predicting emergence and egg laying, using 50°F as a base.</p> <table border="1" data-bbox="167 556 1003 821"> <tr> <td>937 +/- 132 DD</td> <td>First catch on red sphere</td> </tr> <tr> <td>1344 +/- 200 DD</td> <td>First oviposition punctures noted</td> </tr> <tr> <td>1631 +/- 214 DD</td> <td>Peak adult emergence</td> </tr> <tr> <td>2095 +/- 188 DD</td> <td>Apple maggot flight subsiding</td> </tr> </table> <p>Adapted from A. Agnello and H. Reissig, Cornell University.</p>	937 +/- 132 DD	First catch on red sphere	1344 +/- 200 DD	First oviposition punctures noted	1631 +/- 214 DD	Peak adult emergence	2095 +/- 188 DD	Apple maggot flight subsiding	
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<p>18. Obliquebanded leafroller</p> <p>a. The overwintering generation of obliquebanded leafroller is not treated unless need is indicated by systematic sampling for infested clusters or terminals, e.g., 3% infested using the sampling procedure described in the <i>Cornell Guide for Pest Management of Tree Fruit</i>. ^D Score as NA if there is no block or region history of economic injury due to obliquebanded leafroller.</p> <p>b. Degree days are used to calculate treatment timing for summer generations of obliquebanded leafroller. ^D</p> <p>Note: Score as NA if no treatments are made for obliquebanded leafroller. First treatment is applied at 360 degree days (base 43°F) after the first-sustained flight (biofix) and a second applied 10-14 days later. Where oriental fruit moth is controlled chemically, control of obliquebanded leafroller should also be achieved. Where oriental fruit moth is controlled with pheromone mating disruption, additional controls for obliquebanded leafroller may be necessary.</p>									
<p>19. Spotted wing drosophila (SWD) – Peach, plum and nectarine</p> <p>a. If SWD requires chemical control, monitoring is conducted with baited traps to determine when it becomes active in the orchard. ^D</p> <p>Note: Peaches and nectarines harvested with a firmness of 8-12 lbf. (pounds of force) for wholesale or pick-your-own are not a preferred host for SWD. Research in Michigan suggests peaches, plums and nectarines become susceptible when fruit reaches 4 lbf. of firmness. Use a penetrometer with the 5/16-inch head “pear tip” to measure fruit. For guidance on monitoring visit, fruit.cornell.edu/spottedwing/monitoring/. Score NA if SWD management is not necessary.</p>									

A. Minimum Requirements	Pass, Fail or N/A
<p>20. Spotted wing drosophila – Cherry</p> <p>a. If SWD requires chemical control, monitoring is conducted with baited traps to determine when it becomes active in the orchard. ^D</p> <p>Note: Tart and sweet cherries become vulnerable to SWD when fruit starts to turn color. Management programs should begin once fruit has lost its green color AND one or more adult SWD are captured in traps. Make an application of an “excellent” rated product at least every seven to eight days through harvest. Research from Michigan State University Extension from 2017 has revealed additional important practices, such as row mowing and reducing canopy density that reduce risk of SWD infestation. Monitor traps from fruit set through harvest, fruit.cornell.edu/spottedwing/monitoring/. <i>Score NA if SWD management is not necessary.</i></p>	
<p>21. Brown marmorated stink bug (BMSB)</p> <p>a. Blocks at risk for BMSB are scouted for BMSB beginning after petal fall and baited traps are used to monitor BMSB through harvest. In blocks where one adult BMSB is observed within the orchard perimeter along 100 feet of row, or feeding injury is observed, management should begin. Note: BMSB adults disperse into peaches in New Jersey around 170 DD (base 57). Begin to accumulate degree days when day length reaches 13.5 hours; in NJ that is April 22. BMSB can complete their entire lifecycle on peach alone and second-instar nymphs through adults can cause feeding injury. Place traps on perimeter between orchard and hedgerow. Trap thresholds are not established in peaches. ^D</p> <p>b. Perimeter sprays are used to manage BMSB until BMSB nymphs, adults or feeding damage are found in the interior of the block. The perimeter is defined as the first four rows or up to 50 feet from the orchard edge. Note: The majority of adult BMSB stop along the border edge for seven days before going into the interior. This movement is continuous throughout the entire season. Perimeter sprays are found to be most effective on blocks up to 10 acres in size. ^D</p> <p>c. Alternate-row middle or full-block cover sprays may be applied once BMSB nymphs, adults or feeding are found within the interior of the block or blocks that require treatment are larger than 10 acres. ^D</p> <p>d. For each insecticide application for BMSB, efficacy against other pests is considered, e.g., if also effective against apple maggot, no additional application is made for apple maggot during the effective period. ^D</p> <p>Note: See the <i>Eco Apple Quick Guide</i> for a list of approved insecticides for BMSB that have efficacy against other pests. Brown rot infections increase under high BMSB pressure. <i>Score NA if BMSB management is not necessary.</i></p>	

B. Advanced Practices Note: Please list block ID for any blocks not earning points.	Points eligible	Points earned (all blocks)	Blocks not scored
1. No miticides are used other than an early season oil spray. Mites are managed principally by conserving natural enemies. ^D	1		
2. Mite thresholds are adjusted upwards based on varietal susceptibility, current or anticipated weather, or other factors reducing potential for economic injury. ^D	1		
3. Apple maggot (plums) is controlled without pesticide sprays, i.e., trap out. ^D	2		
4. All abandoned pome and stone fruit trees within 100 yards are removed to reduce immigration of insect pests. ^S	1		
5. Wild hosts of tarnished plant bug are removed from the orchard and borders to reduce tarnished plant bug populations. ^S	1		
6. Tree-row volume is used to calculate applications rates. ^D	1		
7. Varieties with lower susceptibility to bacterial spot are grown. ^S	2		
8. Rodents and rabbits are managed without rodenticides, e.g., close mowing, mouse guards, removing drops, encouraging predators and painting trunks with white-latex paint. ^D	1		
9. Remove chokecherries and wild sweet cherries within a 500 feet radius of the orchard; they are a host for X-disease. ^S	1		
10. Biopesticides are used, e.g., <i>Bacillus subtilis</i> , <i>Bacillus thuringiensis</i> , granulosis virus. ^D	1		
11. Where oriental fruit moth requires intervention, mating disruption is used. ^D Note: Insecticides applied after bloom for control of plum curculio will also have efficacy on first generation oriental fruit moth. Mating disruption for oriental fruit moth may be applied before second generation in mid-June. Mating disruption dispensers lasting 90 days will also provide control in areas with a third generation of oriental fruit moth.	2		
12. Mating disruption is used for peachtree borers. ^D Note: Isomate PTB-Dual dispensers should be placed in orchard at shuck split prior to flight at a rate of 150 ties per acre. Higher rates (200-250 ties/A) should be used for outside edges of border blocks, areas previously without mating disruption and have high populations or in blocks less than five acres.	2		

B. Advanced Practices Note: Please list block ID for any blocks not earning points.	Points eligible	Points earned	Blocks not scored
13. Where BMSB is a concern, populations are monitored using a commercial aggregation-pheromone trap. ^D	2		
14. Buildings are inspected for overwintering populations of BMSB. Large aggregations of overwintering BMSB are removed and disposed of in a tightly sealed trash bag. ^S Note: Anecdotal evidence suggests that removal of overwintering BMSB may help reduce populations, each female may lay up to 500 eggs in a life cycle.	2		
15. No post-harvest fungicides are used. ^D	1		
16. Trunks are painted with white latex paint to prevent trunk splitting and reduce winter sunscald. ^S Note: Trunk splitting can increase attractiveness of trees to dogwood borers.	2		
17. Base of trunks are kept weed-free to reduce environments attractive to borer species. ^S	1		
18. Trees heavily infested ($\geq 75\%$ dead or dying) by borer larvae are removed from the orchard and burned before the following spring. Stumps must also be removed. All large prunings and brush piles are either flailed or burned. ^S	1		
19. Canker infested wood are removed from trees and destroyed to promote rapid decomposition, which reduces overwintering inoculum. ^S	1		
20. Row middles are mowed and maintained to reduce risk of SWD infestation. Frequent mowing helps to reduce humidity and create a hot/dry microclimate not favored by SWD. ^S	1		
21. Cherry trees with large canopies are actively pruned to reduce risk of SWD infestation. Pruning helps to reduce humidity within the canopy, enhance light penetration and aids coverage of insecticide applications. ^S	1		
Crop Specific Practices (Stone Fruit): Total points eligible	28		
Total points earned			
Grower participating for one to three years are required to earn a minimum of 3 points. Growers participating more than three years must earn at least 6 points.			

Note: List the block ID for any instances where the scored advanced practice does not apply to the site. Total points for each block may be reflected in the final score card on page 18 of the *Core Eco Protocol* and Grower Self-Assessment.

Pesticide Hazard and Risk Ranking

The following practices and products are listed for Northeast fruit production. Pesticide active ingredients have been evaluated for necessity to produce quality apples in the Northeast in commercial quantities, and for hazards to humans, natural enemies and other non-targets, potential to contaminate groundwater and resistance management. This is not an exhaustive list of practices or products.

Only fungicides, herbicides and insecticides which have been evaluated against our criteria and appear on the list of approved pesticides may be applied on enrolled blocks. If a fungicide, herbicide or insecticide is not included, please contact the IPM Institute to request a product evaluation. The IPM Institute will confirm receipt of requests within one business day and respond with a resolution within one to three business days.

Note: Trade names are for reference only. Additional trade names may also be available.

Pesticide hazards were analyzed using the database at www.pesticideinfo.org, which collates information from recognized authorities such as US EPA and individual State Lead Agencies (SLAs) for pesticide regulation. SLAs are housed in state departments of agriculture or state environmental management agency, depending on the state.

The Pesticide Risk Tool (pesticiderisk.org) and Windows Pesticide Screening Tool, WIN-PST (go.usa.gov/Kok), have also been used to evaluate pesticide risks.

The following criteria were used to evaluate pesticides:

- Acute toxicity to wildlife, fish, aquatic invertebrates:** Product label, Pesticide Risk Tool
- Acute toxicity:** CAUTION, WARNING or DANGER Label/US EPA, Pesticide Risk Tool
- Neurotoxin:** Cholinesterase inhibitor or listed on Toxics Reduction Inventory maintained by US EPA
- Possible, likely, probable carcinogen:** US EPA, State of California, and International Agency for Research on Cancer
- Reproductive/developmental toxin:** US EPA, State of California, Pesticide Risk Tool
- Toxic to pollinators, key natural enemies/secondary pests:** Product label, Extension recommendations, variety of published sources
- Toxic to wildlife:** Product label, Pesticide Risk Tool
- Suspected endocrine disruptor:** Illinois EPA, Keith, Colburn or Benbrook lists
- Broad spectrum pesticide:** Extension recommendations
- Resistance risk:** Extension recommendations
- Potential or known groundwater contaminant:** State of California, variety of published sources

The following process was used to determine use and use restrictions:

- a. Pesticide options currently in use by growers, or suggested by growers or others, are reviewed for status re the criteria listed above.
- b. There are thousands of pesticides labeled for use specialty crops in the United States. We only review those products currently in use or with strong potential for use, as suggested by participating growers and others.

- c. Pesticides that are useful for our pest issues that do not have hazards as per our criteria, or pesticides with relatively readily mitigated hazards, are placed in “Low-Risk Pesticides, No Restrictions” or “Moderate to High-Risk Pesticides, No Restrictions” category. For example, for most products, aquatic toxicity is readily addressed by following label restrictions to avoid contamination of water bodies. **No pesticides may be used without justification, e.g., sampling and thresholds, or weather monitoring, or block history of a problem where sampling or monitoring methods and thresholds are not available.**
- d. Pesticides with hazards that are less readily mitigated are placed in the “Do Not Use” category. These are then reviewed for necessity in order to produce commercial quality fruit economically. Our goal is to limit the use of products with hazards to those we cannot do without.
- e. Products which are needed to address a key pest are then moved to the “Use with Restrictions (Moderate to High-Risk Pesticides)” category. Measures that we can take to mitigate hazards are included, e.g., limiting the number of applications, or limiting use to one pest issue where the product is critical for adequate control.
- f. Other products with similar hazards are not moved to the “Use with Restrictions (Moderate to High-Risk Pesticides)” category because the hazard profile is similar to those already in that category, but only if their use is a critical need that we identify as a group.
- g. This is a subjective process. Definitive data are not available on many of the considerations here, e.g., thresholds are lacking for many pests, efficacy is variable, and development of resistance is a concern if available modes of action are limited. We don’t know for sure exactly where to draw the line. We try to reach consensus on issues but realize this will not be possible in all cases. The protocol belongs to Red Tomato, which delegates the final decision on contentious issues to the IPM Institute.
- h. A timeline for new products that do not have approved labels by the annual meeting will be provided, e.g., Section 18 exemption label approvals for brown marmorated stink bug and mid-season product releases. These products will be listed under their appropriate use category as per the review process and will include anticipated release date. **Products may not be used until a label has been approved for the state in which they will be used.** Applications made prior to the label approval date will be considered a protocol violation and result in disqualification of the blocks which received treatment.

Pesticide Use Restrictions

IMPORTANT: All of the following products may not be registered in every state. Please confirm the product is labeled for use in your state!

LOW-RISK PESTICIDES, NO RESTRICTIONS BEYOND THOSE ON THE PRODUCT LABEL

1. These pesticides may be used to the full extent of the pesticide label and pose minimal risk to environmental and human health.
2. Use only after systematic scouting or weather monitoring and science-based thresholds, or according to previous history where thresholds are not available.
3. Pesticides included are not a guarantee of efficacy. Some products will not be as effective as other products against specific target pests.

Trade Name	Active Ingredient	Concerns	Best Practice
Insect/Mite Management			
CheckMate, Disrupt, IsoMate; hand-applied and sprayable pheromone formulations	1-dodecanol, 1-tetradecanol		Pheromone mating disruption is currently available for borers and oriental fruit moth.
PFR-97	<i>Isaria fumosorosea</i>		
Surround	kaolin		May be applied prior to trap catches based on historical scouting data or degree day model.
Venerate	<i>Burkholderia</i> spp.		
Disease Management			
Double Nickel	<i>Bacillus amyloliquefaciens</i>		
Regalia	<i>Reynoutria sachalinensis</i>		
Serenade	<i>Bacillus subtilis</i>		
Weed Management			
Avenger AG	d-limonene		
Other			
Plantskydd	blood meal		

MODERATE to HIGH-RISK PESTICIDES, NO RESTRICTIONS BEYOND THOSE ON THE PRODUCT LABEL

1. These pesticides may be used to the full extent of the pesticide label. Moderate to high risks to environmental and human health are present.
2. Use only after systematic scouting or weather monitoring and science-based thresholds, or according to previous history where thresholds are not available.
3. Pesticides included are not a guarantee of efficacy. Some products will not be as effective as other products against specific target pests.

Trade Name	Active Ingredient	Concerns	Best Practice
Insect/Mite Management			
Acramite 50 WS	bifenazate	toxic to bees	
Avaunt	indoxacarb	toxic to mammals, birds, fish, aquatic invertebrates, highly toxic to bees	
Aza-Direct, Neemix	azadirachtin	toxic to bees, suspected endocrine disruptor, toxic to fish and aquatic invertebrates	
Agree, Biobit, Deliver, Dipel, Javelin	<i>Bacillus thuringiensis</i>	runoff risk to surface water	
Beleaf 50 SG	flonicamid	Possible carcinogen and potential groundwater contaminant.	
Centaur WDG	buprofezin	potential groundwater contaminant	
Damoil	mineral oil	toxic to fish	Performance is best when relative humidity is less than 65% and temperatures are warmer than 60°F.
Entrust	spinosad	toxic to bees	Do not apply back-to-back applications of this mode of action for SWD.
Envidor 2 SC	spirodiclofen	toxic to fish and aquatic invertebrates, toxic to bees	
Esteem 35 WP	pyriproxyfen	toxic to fish and aquatic invertebrates	
Portal	fenpyroximate	highly toxic to fish and aquatic invertebrates	
Grandevo	<i>Chromobacterium subsugae</i>	toxic to aquatic invertebrates	
Intrepid 2F	methoxyfenozide	hazardous to aquatic invertebrates, potential groundwater contaminant	
Movento	spirotetramat	toxic to aquatic invertebrates and oysters, potential groundwater contaminant, potentially toxic to honey bee larvae	
Zeal WP	etoxazole	toxic to aquatic invertebrates	

MODERATE to HIGH RISK-PESTICIDES, NO RESTRICTIONS BEYOND THOSE ON THE PRODUCT LABEL

Trade Name	Active Ingredient	Concerns	Best Practice
Disease Management			
Captan	captan	acute toxicity to workers, toxic to fish, carcinogen under prolonged exposure to high doses	<ol style="list-style-type: none"> 1. Tank mixtures not recommended between petal fall and first cover to reduce risk of fruit russeting. 2. Use CAUTION or WARNING labels where possible.
C-O-C-S	copper oxychloride, copper sulfate	toxic to fish and aquatic invertebrates	
Cueva	copper octanoate	leaching risk to ground and surface water	
Cuprofix Ultra 40 Disperss	copper sulfate	toxic to bees	
Elevate 50 WDG	fenhexamid	toxic to fish and aquatic invertebrates, potential groundwater contaminant	
Flowable Sulfur	sulfur	toxic to small mammals and fish	
Lime-Sulfur Solution	calcium polysulfide	toxic to birds, surface water contaminant	
Mycoshield	oxytetracycline	known developmental and reproductive toxin	
OSO 5%SC	polyoxin D zinc salt	developmental/reproductive toxin	
Phostrol, Fosphite	phosphorus acid	toxic to fish, surface water contaminant	
ProPhyt	potassium phosphite	toxic to fish, surface water contaminant	
Scholar SC	fludioxonil	toxic to fish and aquatic invertebrates	
Syllit FL	dodine	acute toxicity to workers, resistance	Do not use where resistance is suspected.
Quintec	quinoxifen	high runoff potential, toxic to fish and other aquatic invertebrates	
Vivando	metrafenone	toxic to fish and aquatic invertebrates	

MODERATE to HIGH RISK-PESTICIDES, NO RESTRICTIONS BEYOND THOSE ON THE PRODUCT LABEL

Trade Name	Active Ingredient	Concerns	Best Practice
Weed Management			
Aim EC	carfentrazone-ethyl	acute toxicity to wildlife, fish, aquatic invertebrates	May also be used for control of root suckers.
Alion	indaziflam	acute toxicity to wildlife, fish, aquatic invertebrates, potential/ known groundwater contaminant	
Chateau	flumioxazin	toxic to aquatic invertebrates	
Fusilade DX	fluazifop-P-butyl	toxic to fish, possible reproductive/developmental toxin	
Matrix	rimsulfuron	potential groundwater contaminant	
Poast Herbicide	sethoxydim	potential groundwater contaminant	
Prowl H2O	pendimethalin	moderate aquatic toxicity, potential ground water contaminant	
Rely	glufosinate-ammonium	moderate risk bird reproductive	
Roundup, Cornerstone, Makaze, Credit	glyphosate	resistance, surface water contaminant, probable carcinogen	May cause tree injury if applied after July 1 st .
Scythe	pelargonic acid	acute toxicity to workers	
Stinger	clopyralid	potential groundwater contaminant, resistance	
Treevix	saflufenacil	potential surface and groundwater contaminant	
Venue	pyraflufen-ethyl	moderate aquatic toxicity, potential groundwater contaminant	

USE WITH RESTRICTIONS (MODERATE to HIGH-RISK PESTICIDES), RESTRICTIONS WHICH EXCEED THE PRODUCT LABEL

1. These pesticides have additional restrictions which supersede the pesticide label to mitigate moderate to high risks to environmental and human health.
2. Use with justification and only when less hazardous alternatives (e.g., those listed above) are not adequate.
3. Use only after systematic scouting or weather monitoring and science-based thresholds, or according to previous history where thresholds are not available.
4. Pesticides included are not a guarantee of efficacy. Some products will not be as effective as other products against specific target pests.

Trade Name	Active Ingredient	Concerns	Eco Stone Fruit Restrictions	Best Practice
Insect/Mite Management				
Insecticide-coated apple maggot spheres			Insecticide-coated spheres may only be used through participation in Extension or USDA research.	
Altacor	chlorantraniliprole	toxic to aquatic organisms and certain beneficials, potential groundwater contaminant	Do not expose more than one generation of the target pest to this mode of action alone.	
Delegate WG	spinetoram	toxic to bees, toxic to aquatic invertebrates	Do not expose more than one generation of the target pest to this mode of action alone.	Do not apply back-to-back applications of this mode of action for SWD.
Exirel	cyantraniliprole	highly toxic to bees, toxic to aquatic invertebrates, potential groundwater contaminant	<ol style="list-style-type: none"> 1. Do not apply until after bloom. 2. Do not expose more than one generation of the target pest to this mode of action alone. 	Do not apply back-to-back applications of this mode of action for SWD.
Lorsban	chlorpyrifos	moderate acute toxicity to workers, cholinesterase inhibitor, suspected endocrine disruptor, broad spectrum, highly toxic to bees	<ol style="list-style-type: none"> 1. Use for trunk borer species only. 2. Apply only as a trunk spray. To avoid contact with fruit, apply when fruit are not present. If fruit are present, do not apply using lower nozzles of an airblast sprayer; use a hand wand, shielded sprayer or other method where drift onto fruit can be avoided. 	Some growers have reported using an herbicide sprayer that has been carefully cleaned prior to the trunk application. There are a number of issues that should be carefully considered before using this strategy, see http://cotton.tamu.edu/Weeds/Cleaning%20Field%20Sprayers.pdf for some of these.
Versys	afidopyropen	Toxic to bees, acute-aquatic toxicity	Do not apply until after bloom.	Not registered in New York.

USE WITH RESTRICTIONS (MODERATE to HIGH-RISK PESTICIDES), RESTRICTIONS WHICH EXCEED THE PRODUCT LABEL

Trade Name	Active Ingredient	Concerns	Eco Stone Fruit Restrictions	Best Practice
Insect/Mite Management				
Neonicotinoids				
Actara	thiamethoxam	toxic to wildlife, highly toxic to aquatic invertebrates, highly toxic to bees, potential groundwater contaminant	1. Do not apply until after bloom. 2. Do not expose more than one generation of the target pest to this mode of action alone.	Additional use restrictions for New York producers, see product label.
Assail	acetamiprid	toxic to wildlife, toxic to bees, may result in spider mite flare up, potential groundwater contaminant	Do not expose more than one generation of the target pest to this mode of action alone.	
Belay	clothianidin	toxic to aquatic invertebrates, highly toxic to bees, potential groundwater contaminant	1. Do not apply until after bloom. 2. Do not expose more than one generation of the target pest to this mode of action alone.	Not registered in New York.
Admire Pro, Alias, Montana	imidacloprid	toxic to aquatic invertebrates, toxic to bees, toxic to earthworms, toxic to wildlife	1. Do not apply until after bloom. 2. Do not expose more than one generation of the target pest to this mode of action alone.	
Scorpion, Venom	dinotefuran	highly toxic to bees and aquatic organisms, potential groundwater contaminant	1. Do not apply until after bloom. 2. Use for brown marmorated stink bug only.	Not registered in New York.
Pyrethroids				
Asana XL	esfenvalerate	extremely toxic to fish and aquatic invertebrates, highly toxic to bees, toxicity to beneficials, suspected endocrine disruptor	1. Use for tarnished plant bug, stink bugs and SWD only. 2. Do not apply back-to-back applications of this mode of action for SWD.	
Baythroid XL	beta-cyfluthrin	acute toxicity to workers, broad spectrum, highly toxic to bees, fish and aquatic invertebrates	1. Use for tarnished plant bug, stink bugs and SWD only. 2. Do not apply back-to-back applications of this mode of action for SWD.	
Brigade WSB, Bifenture 10DF, Bifenture EC	bifenthrin	toxic to bees, earthworms, aquatic invertebrates and fish, acute toxicity to workers, possible carcinogen, developmental or reproductive toxin, suspected endocrine disruptor	Use for BMSB only.	

USE WITH RESTRICTIONS (MODERATE to HIGH-RISK PESTICIDES), RESTRICTIONS WHICH EXCEED THE PRODUCT LABEL

Trade Name	Active Ingredient	Concerns	Eco Stone Fruit Restrictions	Best Practice
Pyrethroids continued				
Danitol	fenpropathrin	toxicity to beneficials, acute aquatic toxicity, highly toxic to bees	<ol style="list-style-type: none"> 1. Use for tarnished plant bug, stink bugs and SWD only. 2. Do not apply back-to-back applications of this mode of action for SWD. 	Additional use restrictions for New York producers, see product label.
Declare, Proaxis	gamma-cyhalothrin	highly toxic to bees, toxic to wildlife, fish and aquatic organisms, suspected endocrine disruptor, broad-spectrum	Use for tarnished plant bug and stink bugs only.	
Leverage 360	beta-cyfluthrin, imidacloprid	acute aquatic toxicity, broad-spectrum, highly toxic to bees	<ol style="list-style-type: none"> 1. Use for tarnished plant bug, stink bugs and SWD only. 2. Do not apply back-to-back applications of this mode of action for SWD. 	
Mustang, Mustang Maxx	zeta-cypermethrin	highly toxic to bees, acute toxicity to workers, toxic to beneficials, suspected endocrine disruptor, possible carcinogen	<ol style="list-style-type: none"> 1. Use for tarnished plant bug, stink bugs and SWD only. 2. Do not apply back-to-back applications of this mode of action for SWD. 	
PyGanic EC	pyrethrins	toxic to aquatic invertebrates and beneficials, highly toxic to bees	Use for tarnished plant bug and stink bugs only.	
Pyrenone crop spray	piperonyl butoxide, pyrethrins	highly toxic to bees, highly toxic to fish, broad-spectrum, suspected endocrine disruptor, possible carcinogen	Use for tarnished plant bug and stink bugs only.	
Besiege	chlorantraniliprole, lambda-cyhalothrin	highly toxic to bees, acute toxicity to workers, toxic to beneficials, suspected endocrine disruptor, acute aquatic toxicity	Use for tarnished plant bug and stink bugs only.	
Warrior II	lambda-cyhalothrin	acute toxicity to workers, toxicity to beneficials, suspected endocrine disruptor, acute aquatic toxicity, highly toxic to bees	Use for tarnished plant bug and stink bugs only.	

USE WITH RESTRICTIONS (MODERATE to HIGH-RISK PESTICIDES), RESTRICTIONS WHICH EXCEED THE PRODUCT LABEL

Trade Name	Active Ingredient	Concerns	Eco Stone Fruit Restrictions	Best Practice
Disease Management				
Badge SC	copper hydroxide, copper oxychloride	acute toxicity to workers, toxic to fish and aquatic invertebrates, toxic to bees	Use CAUTION label formulation only.	
Bravo Weather Stik, Initiate 720	chlorothalonil	acute toxicity to workers, known carcinogen, potential groundwater contaminant	Use CAUTION label formulation only.	
Champ, Kocide	copper hydroxide	acute toxicity to workers, toxic to fish and aquatic invertebrates, toxic to bees	Use CAUTION or WARNING label formulations only.	
Single-Site Fungicides – AP, MBC, SDHI and QoI Groups				
Abound	azoxystrobin ¹¹	potential groundwater contaminant, toxic to fish and aquatic invertebrates	Use only in rotation with a different mode of action. Do not use back-to-back applications.	Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Fontelis	penthiopyrad ⁷	suspected carcinogen, reproductive/development toxin	<ol style="list-style-type: none"> 1. Maximum of two SDHI applications per season. 2. Use only in rotation with a different mode of action. Do not use back-to-back applications. 	<ol style="list-style-type: none"> 1. Tank mixes of captan and Fontelis have been phytotoxic to foliage. 2. Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Gem	trifloxystrobin ¹¹	potential surface water contaminant, resistance	Use only in rotation with a different mode of action. Do not use back-to-back applications.	<ol style="list-style-type: none"> 1. Do not use where resistance is known. 2. Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Topsin	thiophanate-methyl ¹	likely carcinogen, reproductive/developmental toxin, potential groundwater contaminant, resistance	Use only in rotation with a different mode of action. Do not use back-to-back applications.	
Vanguard WG	Cyprodinil ⁹	toxic to fish and aquatic invertebrates, potential groundwater contaminant	Use only in rotation with a different mode of action. Do not use back-to-back applications.	Recommended for using during cool and wet weather.

^{1, 7, 9, 11} Fungicide Resistance Action Committee (FRAC) codes may be used for brown rot resistance management.

USE WITH RESTRICTIONS (MODERATE to HIGH-RISK PESTICIDES), RESTRICTIONS WHICH EXCEED THE PRODUCT LABEL

Trade Name	Active Ingredient	Concerns	Eco Stone Fruit Restrictions	Best Practice
Disease Management				
Sterol Inhibitors (DMIs)				
Indar 2F	fenbuconazole ³	toxic to fish, aquatic invertebrates, algae, EPA possible carcinogen related to crystalline silica content, reproductive effects on female animals	Use only in rotation with a different mode of action. Do not use back-to-back applications.	<ol style="list-style-type: none"> 1. Do not use where resistance is known. 2. Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Orius 45 DF	tebuconazole ³	toxic to estuarine and marine invertebrates, suspected endocrine disruptor	Use only in rotation with a different mode of action. Do not use back-to-back applications.	<ol style="list-style-type: none"> 1. Do not use where resistance is known. 2. Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Rally 40 WSP	myclobutanil ³	developmental/reproductive toxicity, acute aquatic toxicity, resistance	<ol style="list-style-type: none"> 1. Maximum of four applications per season. 2. Use only in rotation with a different mode of action. Do not use back-to-back applications. 	<ol style="list-style-type: none"> 1. Do not use where resistance is known. 2. Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Topguard Specialty	flutriafol ³	suspected endocrine disruptor, potential groundwater contaminant	Use only in rotation with a different mode of action. Do not use back-to-back applications.	<ol style="list-style-type: none"> 1. Do not use where resistance is known. 2. Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Quash	metconazole ³	acute toxicity to workers	Use only in rotation with a different mode of action. Do not use back-to-back applications.	<ol style="list-style-type: none"> 1. Do not use where resistance is known. 2. Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.

³FRAC codes may be used for brown rot resistance management.

USE WITH RESTRICTIONS (MODERATE to HIGH-RISK PESTICIDES), RESTRICTIONS WHICH EXCEED THE PRODUCT LABEL

Trade Name	Active Ingredient	Concerns	Eco Stone Fruit Restrictions	Best Practice
Disease Management				
Premix Fungicides				
Adament 50 WG	trifloxystrobin ¹¹ , tebuconazole ³	toxic to mammals, fish and aquatic invertebrates, potential groundwater contaminant	Use only in rotation with a different mode of action. Do not use back-to-back applications.	Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Inspire Super	difenoconazole ³ , cyprodinil ⁹	possible carcinogen, suspected endocrine disruptor, potential groundwater contaminant	Use only in rotation with a different mode of action. Do not use back-to-back applications.	1. Do not use where resistance is known. 2. Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Pristine	pyraclostrobin ¹¹ , boscalid ⁷	possible carcinogen, toxic to fish and aquatic invertebrates	Use only in rotation with a different mode of action. Do not use back-to-back applications.	Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Quadris Top	azoxystrobin ¹¹ , difenoconazole ³	potential ground and surface water contaminant, toxic to fish and aquatic invertebrates, possible carcinogen	Use only in rotation with a different mode of action. Do not use back-to-back applications.	1. Do not use where resistance is known. 2. Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Luna Experience	fluopyram ⁷ , tebuconazole ³	high risk to avian reproductive, carcinogen, potential groundwater contaminant, suspected endocrine disruptor	1. Maximum of two SDHI applications per season. 2. Use only in rotation with a different mode of action. Do not use back-to-back applications.	Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Luna Sensation	fluopyram ⁷ , trifloxystrobin ¹¹	possible carcinogen, developmental and reproductive toxin	1. Maximum of two SDHI applications per season. 2. Use only in rotation with a different mode of action. Do not use back-to-back applications.	Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.
Merivon	fluxapyroxad ⁷ , pyraclostrobin ¹¹	potential groundwater contaminant	1. Maximum of two SDHI applications per season. 2. Use only in rotation with a different mode of action. Do not use back-to-back applications.	Recommended to tank mix with a protectant fungicide, e.g., Bravo or captan.

^{3, 7, 9, 11} FRAC codes may be used for brown rot resistance management.

USE WITH RESTRICTIONS (MODERATE to HIGH-RISK PESTICIDES), RESTRICTIONS WHICH EXCEED THE PRODUCT LABEL				
Trade Name	Active Ingredient	Concerns	Eco Stone Fruit Restrictions	Best Practice
Weed Management				
Gramoxone	paraquat dichloride	acute toxicity to workers, potential groundwater contaminant, moderate aquatic toxicity	Must be applied using a tractor with an enclosed cab.	
Select (CAUTION label)	clethodim	potential groundwater contaminant	Use CAUTION label formulations only.	
Simazine, Princep, Sim-Trol	simazine	possible carcinogen, reproductive toxin, known groundwater contaminant, acute aquatic toxicity	Limited to one application per season of either simazine or terbacil (not both).	
Sinbar	terbacil	developmental toxin, potential groundwater contaminant	Limited to one application per season of either simazine or terbacil (not both).	
2,4-D	2,4-D	acute toxicity to workers, possible carcinogen	Application restrictions vary between labels.	

DO NOT USE		
Trade Name	Active Ingredient	Concerns
Insect/Mite Management		
Ambush, Pounce	permethrin	acute toxicity to workers, toxicity to beneficials, possible carcinogen, suspected endocrine disruptor, acute aquatic toxicity, highly toxic to bees and broad spectrum
Apollo	clofentezine	possible carcinogen, suspected endocrine disruptor
Apta	tolfenpyrad	highly toxic to fish and aquatic invertebrates, highly toxic bees
Imidan 70-W	phosmet	acute toxicity to workers, cholinesterase inhibitor and broad spectrum, highly toxic to bees
Lannate	methomyl	highly toxic to bees, PAN bad actor chemical, high acute toxicity to workers, cholinesterase inhibitor, potential groundwater contaminant, suspected endocrine disruptor
Malathion	malathion	highly toxic to bees, cholinesterase inhibitor, broad spectrum
Nexter	pyridaben	acute toxicity to workers and acute aquatic toxicity, highly toxic to bees
Proclaim	emamectin benzoate	toxic to fish, birds, mammals and aquatic invertebrates, Restricted Use Pesticide
Rimon 0.83 EC	novaluron	acute toxicity to freshwater and estuarine/marine invertebrates and fish, runoff potential – especially in poorly drained soils and toxic to bees
Savey 50 DF, Onager	hexythiazox	possible carcinogen and moderate aquatic toxicity
Tourismo	buprofezin, flubendiamide	groundwater contaminant and possible carcinogen
Vendex	fenbutatin-oxide	known developmental and reproductive toxin, suspected endocrine disruptor
Vydate L	oxamyl	acute toxicity to workers, broad spectrum and highly toxic to bees

DO NOT USE		
Trade Name	Active Ingredient	Concerns
Disease Management		
Badge X2 (DANGER label)	copper hydroxide, copper oxychloride	acute toxicity to workers, toxic to fish and aquatic invertebrates, toxic to bees
Bravo Ultrex (DANGER label)	chlorothalonil	acute toxicity to workers, known carcinogen, potential groundwater contaminant
Champ WG (DANGER label)	copper hydroxide	acute toxicity to workers, toxic to fish and aquatic invertebrates, toxic to bees
Echo 720, Initiate ZN (WARNING label)	chlorothalonil	acute toxicity to workers, known carcinogen, potential groundwater contaminant
Ferbam	ferbam	acute aquatic toxicity
Mertect 340-F	thiabendazole	possible carcinogen, developmental toxin
Meteor, Rovral	iprodione	possible carcinogen, potential groundwater contaminant, suspected endocrine disruptor
Ridomil Gold SL	mefenoxam	acute aquatic toxicity
Scala SC	pyrimethanil	possible carcinogen and suspected endocrine disruptor
Thiram Granuflo	thiram	reproductive/developmental toxin and suspected endocrine disruptor
Tilt	propiconazole	potential surface and groundwater contaminant
Ziram 76 DF	ziram	acute toxicity to workers, likely carcinogen, developmental/reproductive toxin and suspected endocrine disruptor
Weed Management		
Diquat SPC 2L	diquat dibromide	potential groundwater contaminant, moderate aquatic toxicity
Direx 4L, Karmex DF	diuron	known carcinogen, developmental toxin, acute aquatic toxicity, toxic to birds, potential ground and surface water contaminant
Gallery 75 DF	isoxaben	possible carcinogen, potential groundwater contaminant, moderate aquatic toxicity
Goal 2XL	oxyfluorfen	possible carcinogen, acute aquatic toxicity
Kerb	propyzamide	probable carcinogen, potential groundwater contaminant, moderate aquatic toxicity
Prowl H2O	pendimethalin	possible carcinogen, suspected endocrine disruptor, moderate aquatic toxicity
Select 2 EC (WARNING label)	clethodim	acute toxicity to workers, potential groundwater contaminant
Solicam DF	norflurazon	possible carcinogen, known groundwater contaminant, moderate aquatic toxicity
Surflan AS	oryzalin	likely carcinogen, potential groundwater contaminant, acute aquatic toxicity
Venue	pyraflufen-ethyl	known carcinogen, toxic to fish and aquatic invertebrates

Revisions to the 2019 Edition

1. Removed gray coloring and super scripts from the Pesticide Use Restrictions table for the following pesticides that are no longer prohibited or restricted for growers supplying fruit to Whole Foods Market:
 - i. chlorpyrifos, pg. 16
 - ii. thiophanate-methyl, pg. 19
 - iii. 2,4-D, pg. 22
 - iv. clothianidin, pg. 17
 - v. dinotefuran, pg. 17
 - vi. imidacloprid, pg. 17, 18
 - vii. thiamethoxam, pg. 17

The following pesticides have been added to the *Pesticide Use Restrictions*:

- MODERATE to HIGH RISK-PESTICIDES, NO RESTRICTIONS BEYOND THOSE ON THE PRODUCT LABEL:
 - Prowl H2O (pendimethalin), pg. 15
 - Venue (pyraflufen-ethyl), pg. 15
- USE WITH RESTRICTIONS (MODERATE to HIGH-RISK PESTICIDES), RESTRICTIONS WHICH EXCEED THE PRODUCT LABEL:
 - Versys (afidopyropen), pg. 16
 - Do not apply until after bloom.
 - Not registered in New York

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Spotted wing drosophila

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Brown marmorated stink bug

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