

2024

SOUTHEASTERN
PEACH, NECTARINE, AND PLUM
PEST MANAGEMENT AND
CULTURE GUIDE



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2024 Southeastern Peach, Nectarine, and Plum Pest Management and Culture Guide

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2024 SOUTHEASTERN PEACH, NECTARINE, AND PLUM MANAGEMENT GUIDE

Pest problems vary across the Southeast. This guide covers multiple states and production areas. Pesticide rates are a guideline. Exceptions are noted for specific locations and pests, but this guide does not list every exception. Listed pesticides may not be registered for the uses recommended here in all states. Pesticide rates are expressed as the rate per acre for moderate to severe pest pressure. Thorough spray coverage is very important. Unless otherwise stated, in-season cover sprays should be applied as complete sprays (both sides of each row). A minimum spray volume of 60 gallons/acre is recommended for cover spray applications. The volume of water used with airblast applications, within a range of 60 to 100 gallons/acre of final spray mixture, is normally sufficient and typically does not require adjustment in amount of product per acre. Commercially acceptable control of scab, brown rot, mites, scale insects, peach leaf curl, and bacterial spot, requires thorough coverage, and use of recommended gallonage is quite important. Bacterial spot products are sensitive to concentration (i.e., quantity per volume of water).

This guide is for use by commercial peach growers in the southeastern U.S. Observe all label precautions and recommendations. Brand names of pesticides are given in the spray schedule as a convenience to growers. They are neither an endorsement of the product nor a suggestion that other products with the same active ingredient are ineffective. Efficacy ratings in the following tables range from +, slightly effective, to +++++, highly effective. However, many factors, including pest pressure, time of application, spray coverage and rates, influence the level of pest control achieved.

Throughout this guide, you will see repeated references to Mode of Action (MOA). This is to help you minimize the repetitive use of pesticides that have the same toxic modes of action. Repeated use of materials that share the same mode of action encourages development of pesticide-resistant pests. Groups of pesticides with the same #s share the same mode of action (MOA). Groups that are at medium to high risk of resistance development should always be alternated or tank-mixed (depending on the product label) with members of other groups. You are urged to practice resistance management, for the benefit of your operation and the entire industry. Please refer to the resistance management section of this guide for further information.

DORMANT—AFTER LEAVES HAVE FALLEN BUT BEFORE BUD SWELL

BACTERIAL SPOT may be quite damaging. In many southeastern production areas, virtually all varieties would in most years benefit from bacterial spot sprays from late-dormant through shuck-split. **Even the more bacterial spot-resistant varieties can have significant fruit infection when frequent rains and/or prolonged morning dew/fog prevail from petal fall through second cover.** Use of cultivars with some bacterial spot resistance will reduce risk. **Highly susceptible cultivars, such as O’Henry, Elegant Lady, Juneprince, Summerprince, Flameprince, etc., should automatically receive moderate to extensive bacterial spot spray programs.** All applications are protective in nature; once infection has occurred, neither copper nor oxytetracycline will cure bacterial spot infections. **Producers should develop variety- and block-specific bacterial spot programs well before the first spray. Monitor current weather and long-term forecasts to adjust your bacterial spot program.**

In orchards or regions where bacterial spot is not severe and leaf curl is not a problem, sprays for bacterial spot can be started at 1 to 5% bud swell. The need for subsequent applications and the interval between applications after this delayed dormant application depend on the frequency of rainfall, high humidity and heavy dew. ***When rainfall occurs at least weekly, additional sprays should be applied.*** Some materials have a restricted application interval of usually 5 or 7 days. During periods without rain, use caution, as multiple copper applications without rain may result in greater than expected phytotoxicity due to the accumulation of copper and solubilization when moisture occurs.

The bacterial spot pathogen (*Xanthomonas arboricola* pv. *pruni*) has been shown to have reduced sensitivity to copper and oxytetracycline in some orchards. Copper’s bactericidal activity is expressed by its “free” or “ionic” state. In nature, copper is almost always combined with other elements or minerals. Ionic copper is very reactive, and it kills bacteria; however, ionic copper is also phytotoxic. The amount of ionic copper in solution is greatly influenced by pH. More acidic (pH below 7.0) solutions have more ionic copper, making them more bactericidal, but also more phytotoxic. In contrast, the more basic (pH greater than 7.0) solutions have less ionic copper, are less bactericidal and are less inclined to phytotoxicity. The goal is to achieve a balance between these two extremes.

Copper-containing materials are key bacterial-spot management materials on peaches. **Peach foliage can be very sensitive to copper, and if improperly used, coppers can cause serious phytotoxicity and unacceptable defoliation. Always use the correct rate of copper, and be sure sprayers are correctly calibrated.** Copper recommendations are based on 100 gallons of final mix applied as complete sprays (both sides of each tree row). Reducing the volumes of copper-containing sprays should be done with caution. If you reduce spray volumes and the amount of chemical used remains constant, the chemical concentration increases and with it the risk of phytotoxicity. As volume increases above 100 gal/acre, concentration may decline to ineffective rates. Do not go below 60 gallons/acre. Phytotoxicity is more likely to occur when conditions are slow drying (more than 20 minutes) and cool (less than 55°F) or from excessive copper accumulation on the tree (no rain between applications). Injury is usually to leaves in the form of reddish-yellow discoloration, shot-holes and defoliation. **When copper sprays have been used previously, always inspect the trees for copper injury and try to determine whether an additional copper application may cause unacceptable injury.** Some leaf phytotoxicity should be expected if an effective bactericidal amount of copper is being used. Growers should determine when copper injury exceeds the benefit. The rate of copper may need to be reduced or oxytetracycline used instead.

Many copper-containing fungicide/bactericide products and formulations are labeled. The amount of “metallic (elemental) copper equivalent (MCE)”, which is the potential active (antibacterial) ingredient (a.i.) of these products ranges from 8% to 75% MCE. Thus, the amount of formulated product recommended per acre varies greatly. Also, as formulations of copper are improved for better mixing in the spray-tank and for more uniform distribution and re-distribution over the plant surfaces, less formulated material may be required to provide similar bacterial spot control. Some copper formulations may be tank-mixed with superior oil when application takes place before bud break. **Check label for information.**

DORMANT (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Bacterial spot & leaf curl (continued)	<p><i>cuprous oxide</i> + <i>zinc oxide</i> Nordox 30/30 WG (30% MCE + 30% MZE) or <i>copper hydroxide</i> Kocide 2000 (35% MCE) or Kocide 3000 (30% MCE) or <i>copper oxychloride plus copper hydroxide</i> Badge SC (20% MCE)</p>	<p>6.7-8.3 lb/100 (2-2.5 lb MCE+MZE) 5.7-7.1 lb/100 gal (2-2.5 lb MCE) 6.7-7 lb/100 gal (2-2.1 lb MCE) 7-8.8 pt/100 gal (2-2.5 lb MCE)</p>		<p>12 hr 48 hr/ do not spray within 3 weeks of harvest 48 hr/ do not spray within 3 weeks of harvest 48 hr/do not spray within 3 weeks of harvest</p>	<p>Regardless of the copper formulation used, the MCE rate should not exceed 3.0 lb/acre, preferably in 100 gal. For Nordox 30/30 this rate is 1.5 lb – 2.1 lb MCE + 1.5 lb – 2.1 lb MZE Kocide 3000-O, Cuprofix Ultra 40 Disperss, Nordox 75WG, and Nordox 30/30WG have “organic use (OMRI) status”. As a dormant spray, many copper formulations may also be combined with dormant oil at 2.0 gal per 100 gal of water. Consult labels before using. Copper antibacterial activity and phytotoxicity are pH sensitive. Coppers applied in spray tank water with pH less than 6.5 may have increased risk for phytotoxicity. Plum is on most, but not all, copper labels. Check label before use.</p>
Leaf curl (alone)	<p><i>ferbam</i> MOA M3 Ferbam Granuflo or <i>coppers</i> MOA M1 (% metallic copper equivalent=MCE)</p>	<p>3-4 lb use dormant-applied coppers for leaf curl at dormant-applied bacterial spot rates</p>	<p>+++++ Bacterial Spot +++ Leaf Curl +++</p>	<p>24 hr /21 days 24 hr do not apply within 3 weeks of harvest</p>	<p>Ferbam is the material of choice for leaf curl. Chlorothalonil (various formulations), ziram and Thiram have leaf curl activity, but they are less effective than Ferbam. Where leaf curl is severe, make 2 applications, one early winter after leaf fall and the other prior to bud swell. Orchards receiving captan cover sprays the previous growing season are less affected by leaf curl. Ziram and Ferbam are not labeled for plum. Ziram may be used up to 6 lb per acre for large trees. Where plum pockets is a problem, use chlorothalonil or one of the copper products.</p>

DORMANT (continued)

SCALE, white peach and/or San Jose scale, are serious pests, which are normally present at some level in every orchard. Scale overwinter on trees. Two dormant horticultural oil application(s) should be applied to every acre, every year. Dormant horticultural (superior) oils are more insecticidal and more phytotoxic than verdant (summer) horticultural oils. While the verdant oils are less phytotoxic, unfortunately, they typically provide less scale control. Apply oil sprays dilute, 150-200 gallons/acre. Make your first oil spray in early winter to reduce your tree's dormant season scale burden.

Reduced rate oil sprays 1 – 1.5% (5 to 7.5 gal oil, in 500 gal of water) are suggested early in the dormant season beginning just after 95% of the leaves have fallen, and again in spring as buds swell and begin to break. In the spring, reduced rate oil sprays can be made until early pink bud stage. **Phytotoxicity is seldom seen with oil applications made when daily high and low temperatures are within a 28° to 65°F range, and the 2- to 3-day forecast does not include a harsh cold snap.** Monitor in-season for scale crawlers by flagging limbs with numerous live scale. Cover designated monitoring limbs with plastic bags during oil applications to ensure scale survival on these flagged limbs. Males emerge first. Monitor for males by carefully carving the open end of a film canister to fit tightly over a limb with numerous males and taping it in place. Monitor for crawlers using black tape coated with petroleum jelly to capture the tiny yellow mite-like crawlers against a high-contrast visual background.

 **NOTE:** As of March 1, 2022, the EPA revoked all tolerances for chlorpyrifos on food crops. As such, Lorsban and all other chlorpyrifos products have been removed from this version of the peach guide. However, The EPA guidance document for the use of chlorpyrifos states, “**Applications of chlorpyrifos to or around fruit/nut trees may be considered a non-food use provided applications are made to non-bearing trees (i.e., trees without fruit present at the time of application and that will not bear fruit within one year).**”

UPDATE for 2024: The 8th U.S. Circuit Court of Appeals overturned the EPA's decision to revoke tolerances of chlorpyrifos on food crops.

<https://site.extension.uga.edu/peaches/files/2023/12/Opinion-Vacating-Final-Rule.pdf> Because we do not know the full consequences of this decision yet, chlorpyrifos remains removed from this guide. Please check with your Extension personnel for current restrictions

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Scale & European red mite	<i>dormant horticultural (superior) oil</i>	apply 150 to 200 gal final mix/acre	++++ when 2 sprays are applied	12 hr/pre-bloom only	All blocks, bearing and non-bearing, should receive two dormant oil applications every year. Very thorough spray coverage is essential, or oil will not control scale. Control is optimized with slow tractor speeds to assure full displacement (movement) of air from the tree canopy. Temperatures that are consistent and cool are optimal for oil application. Avoid spraying when temperatures are to drop below 28°F or are expected to be above 65°F. Adjust oil rate down to 1 to 1.5% if you are spraying before firm dormancy in the fall or in the spring as buds swell and approach the pink bud stage. Addition of Centaur or Esteem to oil will improve control if applied after a preponderance of scale have reached the black cap stage. Oil and Centaur mix very poorly at cooler temperatures. To eliminate the risk of an oil + Centaur emulsion clogging sprayers consider applying oil and Centaur in separate applications.
	partially dormant trees	5 to 7.5 gal oil/ 500 gal tank/ (1-1.5%)	+++ when 1 spray is applied		
	fully dormant trees	10 to 20 gal oil/ 500 gal tank/ (2-4%)			
	or				
	<i>superior oil</i>	3.75 to 7.5 gal oil/ 500 gal tank/ (0.75-1.5%)			
	plus				
	<i>pyriproxyfen</i> MOA 7C Esteem 35WP	4-5 oz/acre	+++++	12 hr/14 days	
	or				
	<i>buprofezin</i> MOA 16 Centaur 70W	34.5 oz/acre	+++++	12 hr/14 days	

ORCHARD-FLOOR-MANAGEMENT

DORMANT SEASON HERBICIDE APPLICATIONS TO SUPPRESS BROADLEAF WEEDS WILL **REDUCE THE RISK OF BEE KILL AND REDUCE PLANT BUG ABUNDANCE** BY ELIMINATING BLOOMING WEEDS ON THE ORCHARD FLOOR.

Pest(s)	Material(s)	Formulated product/acre	Effectiveness	Rei/phi	Remarks
Weed Management Apply PRE + POST herbicides	See herbicide product list	Numerous options and combinations. See product list or label.			Apply non-selective post-emergence herbicide with a pre-emergence herbicide in the herbicide strip. This application is generally made between mid-October and early December.
Weed Management Control winter annual weeds on the entire orchard floor. Elimination of broadleaf winter annual weeds should reduce the incidence of plant bugs and mite problems.	<i>2,4-D amine</i> (various formulations) or <i>2,4-D amine + rimsulfuron*</i> or <i>Clopyralid + 2,4-D amine</i> Stinger 3EC or <i>paraquat</i> or <i>glyphosate* + 2,4-D amine</i> or <i>glufosinate* + 2,4-D amine + ammonium sulfate</i>	1-1.5 qt 1/3 to 2/3 pt + 1 qt See label See label 32 to 48 fl. oz	++++ ++++ ++++ ++++ ++++	48 hr/60 days 12 hr/30 days see product labels	Apply to the entire orchard floor 6 to 8 weeks prior to peach bloom for control of emerged winter annual weeds. Trees must be at least 1 year old. 2,4-D will control vetch, cutleaf evening primrose and Carolina geranium, which are hosts for twospotted spider mites. The addition of rimsulfuron will aid in the control of henbit and chickweed as well as provide some residual control. DO NOT use rimsulfuron in row middles established in fescue or other cool season perennial grasses Clopyralid (Stinger and generics) controls thistle, dandelion, clovers, vetch, sowthistle, and common groundsel. Tank mixing Stinger with 2,4-D amine will provide broader spectrum control of winter annual weeds. Clopyralid (Stinger) is not labeled for use in Florida. Weeds that grow in a rosette will regrow after application with paraquat. Paraquat or glyphosate or glufosinate will kill or severely injure all plants growing on the orchard floor. DO NOT use paraquat or glyphosate or glufosinate if row middles are planted in a small grain cover crop or perennial grass sod you do not wish to kill. Glyphosate will not effectively control cutleaf evening primrose or glyphosate resistant horseweed. Glufosinate will provide excellent horseweed control. The addition of 2,4-D amine to glyphosate or glufosinate will improve control of weeds like cutleaf eveningprimrose. *DO NOT APPLY rimsulfuron, paraquat, glyphosate, or glufosinate in row middles planted in a desirable ground cover such as fescue.

DELAYED DORMANT – 1%-5% bud swell

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Bacterial spot & leaf curl	<i>Coppers</i> <i>MOA M1</i> (% metallic copper equivalent=MCE) <i>basic copper sulfate</i> Cuprofix Ultra 40 Disperss (40% MCE) or	2.5 lb/100 gal (1.0 lb MCE)	Bacterial Spot +++ Leaf Curl +++	phytotoxicity concerns restrict copper uses to the recommended rates & phenologies 48 hr/do not apply after shuck split	COPPER RATE REDUCTIONS ARE TIED TO CROP DEVELOPMENT; RATES MUST BE DRAMATICALLY REDUCED AS THE SEASON PROGRESSES. CAREFULLY NOTE RATE REDUCTIONS FOR EACH GROWTH STAGE. Where high rates of copper were used in the dormant spray, the delayed dormant spray should NOT be applied for at least 2 weeks or at least one meaningful rainfall since the dormant spray. Otherwise, the accumulation of copper on the tree may cause unacceptable phytotoxicity to emerging leaves. Copper antibacterial activity and phytotoxicity are pH sensitive. Coppers applied in spray tank water with pH less than 6.5 may have increased risk for phytotoxicity. Plum is on most, but not all, copper labels. Check label before use. For Nordox 30/30 this rate is 0.9 lb – 1.2 lb MCE + 0.9 lb – 1.2 lb MZE Kocide 3000-O, Cuprofix Ultra 40 Disperss, Nordox 75WG, and Nordox 30/30WG have “organic use (OMRI) status”.
	<i>cuprous oxide</i> Nordox 75WG (75% MCE) or	1.3-1.7 lb/100 gal (1.0-1.25 lb MCE)		12 hr	
	<i>cuprous oxide + zinc oxide</i> Nordox 30/30 WG (30% MCE + 30% MZE) or	3.3-4.2 lb/100 gal (1-1.25 lb MCE+MZE)		12 hr	
	<i>copper hydroxide</i> Kocide 2000 (35% MCE) or	2.9-3.6 lb/100 gal (1-1.25 lb MCE)		48 hr/ do not apply within 3 weeks of harvest	
	Kocide 3000 (30% MCE) or	3.3-4.2 lb/100 gal (1-1.25 lb MCE)		48 hr/ do not apply within 3 weeks of harvest	
	<i>copper oxychloride plus copper hydroxide</i> Badge SC (20% MCE)	3.5-4.4 pt/100 gal (1-1.25 MCE)		48 hr/ do not apply within 3 weeks of harvest	

DELAYED DORMANT (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Lesser peachtree borer	<i>dormant horticultural (superior) oil</i> plus	apply 150 to 200 gal final mix/acre 3.75 to 7.5 gal oil/ 500 gal tank/ applied to (0.75-1.5%)			REDUCE OIL RATE TO 0.75 to 1.5% OIL BY VOLUME AFTER BUD SWELL TO REDUCE THE RISK OF PHYTOTOXICITY. DO NOT USE DORMANT HORTICULTURAL (SUPERIOR) OIL AFTER 5% PINK BUD.  Note, gal/acre can be lowered to 100 gal/acre when applied post-pruning. Application prior to pruning should remain upwards of 150-200 gal/acre
	<i>Esfenvalerate</i> MOA 3 Asana XL <i>pheromone mating disruption ties</i> Isomate-PTB Dual Isomate-LPTB Plus	2-5.8 fl oz 100-200 ties/acre 100-200 ties/acre	+++ +++ (LPTB) +++ (PTB)	12 hr/14 days	Esfenvalerate provides suppression of lesser peachtree borer when applied at bud swell; control is enhanced when applied with 0.75 to 1.5% oil. Careful monitoring of all mating disruption blocks by trained IPM professionals is strongly recommended. LPTB-infested orchards are unlikely to show reduced pupal case counts until at least 2 years of mating disruption. Isomate-LPTB Plus is currently only labeled for GA and SC.
Scale (alone)	<i>dormant horticultural (superior) oil</i> plus	3.75 to 7.5 gal oil/ 500 gal tank/ applied to (0.75-1.5%)			
	<i>pyriproxifen</i> MOA 7C Esteem 35WP or	4-5 oz	+++++	12 hr/14 days	Addition of Centaur or Esteem to oil will improve control if applied after a preponderance of scale have reached the black cap stage.
	<i>buprofezin</i> MOA 16 Centaur 70W	34.5 oz	+++++	12 hr/14 days	Oil and Centaur mix poorly at cooler temperatures. To eliminate the risk of an oil + Centaur emulsion clogging sprayers consider applying oil and Centaur in separate applications.
	<i>Burkholderia</i> A396 MOA UN Venerate XC or	2 qt	++	4 hr/0 days	Contains metabolites produced during fermentation of <i>Burkholderia</i> spp. strain A396. Venerate is OMRI approved and thus may be useful in both organic and conventional fruit production for insecticide resistance management.
	<i>Burkholderia</i> A396 MOA UN Venerate XC plus	2 qt	++++	4 hr/0 days	Efficacy of Venerate XC for scale management significantly increases when combined with horticultural oil.
	<i>dormant horticultural (superior) oil</i>	3.75 to 7.5 gal oil/ 500 gal tank/ applied to (0.75-1.5%)			

PINK to 5% BLOOM

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Bacterial spot	<p><i>Coppers</i> <i>MOA M1</i> (% metallic copper equivalent=MCE)</p> <p><i>basic copper sulfate</i> Cuprofix Ultra 40 Disperss (40% MCE) or</p> <p><i>cuprous oxide + zinc oxide</i> Nordox 30/30 WG (30% MCE + 30% MZE) or</p> <p>Kocide 2000 (35% MCE) or</p> <p><i>copper hydroxide</i> Kocide 3000 (30% MCE) or</p> <p><i>copper oxychloride plus copper hydroxide</i> Badge SC (20% MCE)</p>	<p>1.25-1.5 lb/100 gal (0.5-0.6 lb MCE)</p> <p>1.7-2.5 lb/100 (0.5-.75 lb MCE+MZE)</p> <p>1.4-2.1 lb/100 gal (0.5-0.75 lb MCE)</p> <p>1.7-2.5 lb/100 gal (0.5-0.75 lb MCE)</p> <p>1.8-2.6 pt/100 gal (0.5-0.75 lb MCE)</p>	Bacterial Spot +++	<p>phytotoxicity concerns restrict copper uses to the recommended rates & phenologies</p> <p>48 hr/do not apply after shuck split</p> <p>12 hr</p> <p>48 hr/ do not apply within 3 weeks of harvest</p> <p>48 hr/do not apply within 3 weeks of harvest</p> <p>48 hr/do not apply within 3 weeks of harvest</p>	<p>COPPER RATE REDUCTIONS ARE TIED TO CROP DEVELOPMENT; RATES MUST BE DRAMATICALLY REDUCED AS THE SEASON PROGRESSES. CAREFULLY NOTE RATE REDUCTIONS FOR EACH GROWTH STAGE.</p> <p>Copper antibacterial activity and phytotoxicity are pH sensitive. Coppers applied in spray tank water with pH less than 6.5 may have increased risk for phytotoxicity.</p> <p>Regardless of copper formulation used, the rate of MCE at Pink to 5% Bloom should not exceed 0.60 lb MCE/acre, preferably in 100 gal. If mild foliar injury occurs, use lower rates. If injury is deemed unacceptable, do not use copper.</p> <p>Plum is on most, but not all, copper labels. Check label before use.</p> <p>For Nordox 30/30 this rate is 0.50 lb MCE + 0.50 lb MZE</p> <p>Kocide 3000-O, Cuprofix Ultra 40 Disperss, Nordox 75WG, and Nordox 30/30WG have “organic use (OMRI) status”.</p>
<p>BLACK KNOT—<i>Apiosporina morbosum</i> is a serious disease of plums and an occasional disease of peaches in the Eastern and North Central states. In the Southeast, black knot is largely restricted to plums. Sanitation in the form of pruning out black knot cankers on scaffold wood is an absolute necessity; spraying alone is unlikely to control black knot in infested plum orchards. Wild plums and cherries within 600 feet of orchards should be rogued out. Chemical controls should be applied through the period of active shoot elongation to ensure protection of susceptible new growth.</p>					
Black knot of plum (continued on next page)	<p><i>chlorothalonil</i> <i>MOA M5</i> Bravo Weather Stik or Equus 720 or ECHO 720 or</p>	3-4 pt	+++	12 hr/do not apply after shuck split	<p>Chlorothalonil and captan are severe eye irritants. Although the restricted-entry interval expires after 12 hours, for 7 days after use, entry is permitted only when the following safety measures are provided.</p> <p>(1) At least one container designed specifically for flushing eyes must be available in operating condition at the mandatory WPS-required decontamination site.</p>

PINK to 5% BLOOM (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Thrips (continued)	<i>abamectin</i> MOA 6 Agri-Mek 0.15EC	2.5-5 fl oz	++	12 hr/21 days	<p>No Grandevo thrips performance data are available from Southeastern stone fruit. Suggested for trial use only. Do not apply during bloom, repels bees for up to 4 days. Large droplet sizes are best.</p> <p>Grandevo is harmful to workers if inhaled, swallowed or absorbed through the skin. PPE for applicators and other handlers is long sleeves, long pants, waterproof gloves, shoes and socks, and protective eyewear.</p> <p>SpinTor can be used with minimal risk to bees at pink bud stage by spraying after foraging has ceased in early evening.</p> <p>SpinTor /Entrust and Delegate have good worker safety and compatibility with hand thinning at bloom.</p> <p>Delegate has longer residual than SpinTor. Unfortunately, this makes pink bud applications of Delegate riskier for bees. Delegate’s longer residual also makes it likely that thrips would develop resistance to the spinosyn class (MOA 5) faster with Delegate use than when treated with SpinTor.</p> <p>Control of thrips may be improved by addition of an adjuvant to the spray mixture (see label for more information).</p>
	<i>Bacterium Chromobacterium subtsugae</i> strain PRAA-4-1 Grandevo	3 lb	?	4 hr/0 days	
	<i>Spinosyns spinosad</i> MOA 5 SpinTor 2SC or Entrust 80W	4-8 fl oz 25 oz	++	4 hr/ 7 days for plums & 1 day for peach and nectarines	
	<i>spinetoram</i> MOA 5 Delegate WG	4.5-7 oz	++	4 hr/1 day	
	<i>spinosad</i> MOA 5 Success	4-8 fl oz	++	4 hr/ 7 days for plums & 1 day for peach and nectarines	

BLOOM

PROTECT BEES and OTHER POLLINATORS—DO NOT APPLY INSECTICIDES DURING BLOOM

PROTECTING BEES AND OTHER POLLINATORS IS ESPECIALLY CRITICAL AT PINK AND PETAL FALL. DO NOT APPLY INSECTICIDE TO BLOCKS IN BLOOM. USE HERBICIDES OR CLOSE MOWING TO ELIMINATE OR SUPPRESS BLOOM OF ORCHARD FLOOR COVER SPECIES. IF A THRIPS SPRAY IS NEEDED AT PINK OR PETAL FALL, WAIT UNTIL BEES HAVE

CEASED TO FORAGE IN EARLY EVENING AND USE THE LEAST TOXIC MATERIALS.

BLOSSOM BLIGHT— Blossom blight is an erratic disease. If untreated, blossom blight can dramatically increase the risk of heavier pre-harvest brown rot pressure. Two blossom blight sprays are recommended in blocks where brown rot was a problem the previous year or if brown rot cankers and/or mummies were seen during dormant pruning. Conversely, blossom blight sprays may be omitted in blocks where initial inoculum sources, including wild *Prunus*, are absent within 0.25 miles. Blossom blight sprays should use captan, chlorothalonil, thiophanate-methyl plus captan, Rovral or Vanguard.

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Black knot of plum	<i>chlorothalonil</i> MOA M5 Bravo Weather Stik (6 lb/gal) or Equus 720 or ECHO 720	3-4 pt	+++	12 hr/do not apply after shuck split	<p>Sanitation is imperative to control black knot. Black knot should be pruned out of infested plum orchards annually. Wild plums and cherries within 600 feet of orchards should be rogued.</p> <p>Chlorothalonil and captan are severe eye irritants. Although the restricted-entry interval expires after 12 hours, for 7 days after use, entry is permitted only when the following safety measures are provided.</p> <p>(1) At least one container designed specifically for flushing eyes must be available in operating condition at the mandatory WPS-required decontamination site.</p> <p>(2) Workers must be informed, in a manner they can understand:</p> <ul style="list-style-type: none"> that residues in the treated area may be highly irritating to their eyes. that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes. that if they do get residues in their eyes, they should immediately flush their eyes using the eyeflush container that is located at the decontamination site or using other readily available clean water. how to operate the eyeflush container. <p>Always tank-mix thiophanate-methyl fungicides with a fungicide having a different mechanism of action, such as captan.</p>
	<i>thiophanate-methyl</i> MOA I Topsin M 70WSB plus <i>captan</i> MOA M4 Captan 50W or	1.5 lb			
	Captan 50W or	3 lb			
	Captec 4L	2qt	++++	24 hr/1 day	
Blossom blight	<i>captan</i> MOA M4 Captan 50W or 80WDG or Captec 4L	4-6 lb 2.5-3.75 lb 2-3 qt	+++	24 hr/0 days	<p>Captan has activity against scab, gummosis, blossom blight, green fruit rot and/or brown rot. Most, if not all, formulations have a 24 hr REI. Check labels for possible exceptions.</p> <p>Chlorothalonil and captan are severe eye irritants. Although the restricted-entry interval expires after 12 hours, for 7 days after use, entry is permitted only when the following safety measures above.</p>
(continued on next page)	or <i>chlorothalonil</i> MOA M5 Bravo Weather Stik (6 lb/gal) or	3-4 pt	++++	12 hr/do not apply after shuck split	

BLOOM (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks	
Blossom blight (continued)	<i>chlorothalonil</i> MOA M5		++++	12 hr/do not apply after shuck split		
	Bravo Ultrex (0.825 ai/lb) WDG or Equus 720 (6 lb/gal) or ECHO 720 or <i>thiophanate-methyl</i> MOA 1	2.8-3.8 lb 3-4 pt			12 hr/1 day	Use thiophanate-methyl only once per year, as resistance develops very readily to benzimidazole class fungicides. Always tank-mix thiophanate-methyl with a fungicide having a different mechanism of action, such as captan. Captan rates may be reduced to 3 lb (50W) or 1.5 qt (4L) when it is tank-mixed with thiophanate-methyl. Benzimidazoles have residual activity against scab, and they are active against gummosis and Botrytis. Resistance is a concern.
	Topsin-M 70W or Topsin-M 70WSB or Thiophanate Methyl 85WDG plus <i>captan</i> MOA M4 Captan 50W or 80WDG or Captec 4L	1.25 lb 1.25 lb 1 lb		+	24 hr/0 days	Captan, a multi-site fungicide, is suggested as a resistance management tank-mix partner for thiophanate-methyl (Topsin-M), which is resistance prone.
	or <i>iprodione</i> MOA 2 Rovral 4F	2 pt		++++	24 hr/do not apply after petal fall	Use Rovral with caution, resistance is present in some orchards. Do not use Rovral after petal fall on peaches or plums. Rovral also has activity against Botrytis.
	or <i>cyprodinil</i> MOA 9 Vanguard 75WG	5 oz		++++	12 hr/do not apply after bloom	Limit of 2 Vanguard/Scala applications per season. Do not apply after bloom. Vanguard also has activity against Botrytis.
	or Scala Brand SC	18 fl oz		++++	12 hr/30 days	If Vanguard/Scala are mixed with a protectant, the rate can be reduced to 9 fl oz. Scala also has activity against Botrytis. Do not use on cherries.
						FRAC 3 fungicides such as Tilt, Indar, Cevya, or Tebuzol are registered for blossom blight control but for resistance management reasons we recommend limiting their use for preharvest brown rot control.

PETAL FALL TO 1% SHUCK SPLIT—Warm weather promotes rapid fruit development. However, cold can delay or even re-start flower/fruit development. Immediately after petal fall, insecticides are typically needed every 7-10 days.

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Scab	sulfur <i>MOA M2</i>	9-12 lb	++	24 hr/0 days	<p>Petal fall is ill-defined, since shuck split and petal fall often overlap to some degree – with young peach fruit tissue exposed when any shuck is removed. Though petal fall scab sprays are of limited value as compared to the more advanced shuck split stage, they can have value. If conditions are particularly favorable for scab development, no strategy can undo infections that develop because of a missed spray, so coverage of exposed peach tissue during petal fall can be important to a good management program.</p> <p>Chlorothalonil provides 14-21 days of scab control. Chlorothalonil is not labeled for use after shuck split.</p> <p>Chlorothalonil and captan are severe eye irritants. Although the restricted-entry interval expires after 12 hours, for 7 days after use, entry is permitted only when the following safety measures are provided.</p> <p>(1) At least one container designed specifically for flushing eyes must be available in operating condition at the mandatory WPS-required decontamination site. (2) Workers must be informed, in a manner they can understand:</p> <ul style="list-style-type: none"> that residues in the treated area may be highly irritating to their eyes. that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes. that if they do get residues in their eyes, they should immediately flush their eyes using the eyeflush container that is located at the decontamination site or using other readily available clean water. how to operate the eyeflush container. <p>If scab pressure is very high (perhaps trees were not sprayed in previous year), consider using Abound or Flint Extra at petal fall and Quadris Top at shuck split, followed by Captan products in the first and second cover for superior scab management. The petal fall application will also provide some kick-back action against blossom blight. This is not recommended as a routine program due to resistance management concerns.</p> <p>Do not use any FRAC 7, 11, or 3 product more than four times per season</p>
	or				
	<i>chlorothalonil</i> <i>MOA M5</i> Bravo Weather Stik (6 lb/gal)	3-4 pt	+++++	12 hr/do not apply after shuck split	
	or Bravo Ultrex (0.825 ai/lb) WDG	2.8-3.8 lb			
	or Equus 720 (6 lb/gal)	3-4 pt			
	or ECHO 720				
	or <i>captan</i> <i>MOA M4</i> Captan 50W or 80WDG Captec 4L	4-6 lb 2.5-3.75 lb 2-3 qt	++++	24 hr/0 days	
	Azoxystrobin <i>MOA FRAC 11</i> Abound	12-15.5 lb	++++	4 hr/0 days	
	Pyraclostrobin <i>MOA FRAC 11</i> GEM 500SC	1.9-3.8 fl oz	++++	4 hr/0 days	
<i>Pydiflumetofen</i> <i>MOA 7</i> Miravis	5.1 fl oz	+++++	4 hr/0 days		

PETAL FALL TO 1% SHUCK SPLIT (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Bacterial spot	<p><i>Coppers</i> <i>MOA M1</i> (% metallic copper equivalent=MCE)</p>		+++	<p>phytotoxicity concerns restrict copper uses to the recommended rates & phenologies</p>	<p>USE CAUTION IF COPPERS ARE USED POST-BLOOM. THE RECOMMENDED RATE REDUCTIONS LESSEN, BUT DO NOT ELIMINATE, PHYTOTOXICITY. SOME FORMULATIONS OF COPPER ARE <u>NOT</u> LABELED FOR USE AFTER THE BLOOM AND SHUCK SPLIT SPRAYS.</p>
	<p><i>basic copper sulfate</i> Cuprofix Ultra 40 Disperss (40% MCE)</p>	<p>0.5-1.0 lb/100 gal (0.2-0.4 lb MCE)</p>		<p>48 hr/do not apply after shuck split</p>	<p>COPPER RATE REDUCTIONS ARE TIED TO CROP DEVELOPMENT; RATES MUST BE DRAMATICALLY REDUCED AS THE SEASON PROGRESSES. CAREFULLY NOTE RATE REDUCTIONS FOR EACH GROWTH STAGE.</p>
	<p>or</p>				<p>Where coppers are used post-bloom, drying conditions should be excellent. Do not apply during extended dews or foggy conditions.</p>
	<p><i>copper hydroxide</i> Kocide 3000 (30% MCE)</p>	<p>0.5 lb/100 gal (0.15 lb MCE)* See remark</p>		<p>48 hr/ do not apply within 3 weeks of harvest</p>	<p>Regardless of the copper formulation used, the rate of MCE at petal fall should not exceed 0.50 lb MCE /acre, preferably in 100 gal. If mild foliar injury occurs, use lower rates. If injury is deemed unacceptable, do not use copper.</p>
<p>or</p>			<p>For Nordox 30/30 this rate is 0.3 lb MCE + 0.3 lb MZE</p>		
<p><i>copper oxychloride plus copper hydroxide</i> Badge SC (20% MCE)</p>	<p>0.7-1.4 pt/100 gal (0.2-0.4 lb MCE)</p>	<p>48 hr/do not apply within 3 weeks of harvest</p>	<p>Kocide 3000-O, Cuprofix Ultra 40 Disperss, Nordox 75WG, and Nordox 30/30WG have “organic use (OMRI) status”.</p> <p>Copper antibacterial activity and phytotoxicity are pH sensitive. Coppers applied in spray tank water with pH less than 6.5 may have increased risk for phytotoxicity.</p> <p>Plums are on most, but not all, copper labels. Check label before use.</p> <p>Coppers are concentration-sensitive materials. Rates are typically expressed as amount of formulated copper product/100 gal/acre. If gal sprayed/acre are reduced after shuck split/shuck off, it is important to reduce copper rates proportionately, otherwise phytotoxicity is likely to increase.</p> <p>*This labeled rate of Kocide 3000 is lower than desired for this phenology (desired rate is 0.2-0.4 lb MCE per acre); consider using another product to provide more MCE.</p>		

PETAL FALL TO 1% SHUCK SPLIT (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Black knot of plum	<i>chlorothalonil</i> MOA M5 Bravo Weather Stik (6 lb/gal) or Equus 720 or ECHO 720	3-4 pt	+++	12 hr/do not apply after shuck split	<p>Sanitation is imperative in order to control black knot. Black knot should be pruned out of infested plum orchards annually. Wild plums and cherries within 600 feet of orchards should be rogued.</p> <p>Chlorothalonil and captan are severe eye irritants. Although the restricted-entry interval expires after 12 hours, for 7 days after use, entry is permitted only when the following safety measures are provided.</p> <p>(1) At least one container designed specifically for flushing eyes must be available in operating condition at the mandatory WPS-required decontamination site.</p> <p>(2) Workers must be informed, in a manner they can understand:</p> <ul style="list-style-type: none"> that residues in the treated area may be highly irritating to their eyes. that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes. that if they do get residues in their eyes, they should immediately flush their eyes using the eyeflush container that is located at the decontamination site or using other readily available clean water. how to operate the eyeflush container.
	<i>thiophanate-methyl</i> MOA 1 Topsin-M 70W or Topsin-M 70WSB or Thiophanate Methyl 85WDG	1.5 lb 1.5 lb 1.2 lb	++++	12 hr/1 day	
	plus <i>captan</i> MOA M4 Captan 50W or 80WDG or Captec 4L	3 lb 1.8 lb 2 qt		24 hr/0 days	
Plant bugs Oriental fruit moth Plum curculio	<i>Organophosphate</i> <i>phosmet</i> MOA 1B Imidan 70W	2-2.25 lb	++++	4 days/14 days for peach & nectarine, 7 days/7 days for plum (14 days for hand harvesting)	 DO NOT APPLY ANY INSECTICIDE BEFORE PETAL FALL. DO NOT APPLY INSECTICIDE IF BEES ARE FORAGING ON THE ORCHARD FLOOR. Imidan efficacy may be reduced in spray solutions of pH 7 or higher. Buffering or acidifying agents are recommended as needed. If not in fully enclosed protective cabs, mixers, loaders and airblast applicators must wear coveralls, chemical resistant gloves & footwear, and an approved respirator. Airblast applicators must also wear chemical resistant headgear.
	<i>Diamide</i> MOA 28 <i>chlorantraniliprole</i> Altacor 35WDG	3-4.5 oz	+++	4 hr/10 days	The diamides are most effective on Lepidopteran larvae, such as oriental fruit moth. There is some contact activity, with exposed insects becoming paralyzed and dying within 1-3 days. More effective when treated plant material is consumed.
	<i>cyantraniliprole</i> Exirel	10-20.5 oz	+++	12 hr/3 days	
	<i>cyclaniliprole</i> Verdepryn 100SL	5.5-11 fl oz	+++	4 hr/7 days	
	<i>Mix</i> <i>thiamethoxam</i> + <i>chlorantraniliprole</i> MOA 4A + 28 Voliam Flexi	6-7 oz	+++	12 hr/14 days	Note that Voliam Flexi is a pre-mixed product that contains groups 4A and 28.
(continued on next page)					

PETAL FALL TO 1% SHUCK SPLIT (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Plant bugs Oriental fruit moth Plum curculio (continued)	<i>Pyrethroids</i> MOA 3A <i>esfenvalerate</i> Asana XL	2-5.8 fl oz	++++	12 hr/14 days	<i>Pyrethroids (MOA 3A)</i> applied at petal fall at low to moderate rates provide excellent control of oriental fruit moth and good control of plant bugs. Residual control of plum curculio improves after two or three pyrethroid sprays are made. Spray at 7- to 10-day intervals for the first three applications. Higher pyrethroid rates are required beginning at shuck split, because plum curculio, borers and stink bug pressure typically increase by shuck split.
	<i>beta cyfluthrin</i> Baythroid XL 1EC	2 fl oz	++++	12 hr/7 days	
	<i>zeta cypermethrin</i> Mustang Maxx	3 fl oz	++++	12 hr/14 days	At petal fall, when plant bugs are typically the most damaging species, pyrethroid rates may be reduced. Higher pyrethroid rates are necessary beginning at shuck split.
	<i>cyfluthrin</i> Tombstone 2EC	2 fl oz	++++	12 hr/7 days	
	<i>lambda cyhalothrin</i> Lambda-T 1EC or Silencer 1EC or Warrior II	4 fl oz 4 fl oz 1.28-2.56 fl oz	++++	24 hr/14 days	
		<i>permethrin</i> Ambush 25W (peach only) Pounce 25WP (peach & nectarine) <i>permethrin</i>	19 oz 6.4-16 oz	+++	12 hr/14 days
Peachtree and lesser peachtree borer	<i>pheromone mating disruption ties</i> Isomate-PTB Dual Isomate-LPTB Plus	100-200 ties/acre 100-200 ties/acre	+++ (LPTB) +++ (PTB)		Pheromone-based mating disruption. Apply prior to moth emergence in the spring. Place dispensers on lateral branches in mid-point of tree canopy, uniformly throughout the orchard. Best results are found with areawide approach to mating disruption. Isomate-LPTB Plus is currently only labeled for GA and SC

SHUCK SPLIT to 10% SHUCK OFF COVER SPRAY

Cover sprays occur after the petal fall spray – a spray applied to cover fruit. As such, all sprays after bloom and up to preharvest sprays are considered to be cover sprays. Peaches have unique cover spray designators (e.g. shuck split) that are important to understand. For bacterial spot management, many labels specifically address the first and second cover sprays as application timings for bacterial spot management. However, petal fall applications are equally important as well, since many fruit will be exposed (shuck split) as petal fall occurs; some products allow for a petal fall application and some do not, so read the labels carefully. Some products allow for cover spray application and some do not, so again, read the labels carefully. The sprays that occur at petal fall through 7-10 days after shuck split are critical to disease control, as bacterial infection occurs readily during this timeframe, but infection can continue through at least pit-hardening. As such, cover sprays with either copper or oxytetracycline products are required at petal fall and throughout cover sprays on susceptible varieties. Note all label instructions and review preharvest intervals carefully.

Scab sprays are critical from shuck split through 2nd and 3rd cover.

SHUCK SPLIT TO 10% SHUCK OFF COVER SPRAY (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Bacterial spot	<i>oxytetracycline</i> MOA 4I		++	12 hr/21 days	Oxytetracycline is most effective when applied shortly before rain or extended periods of leaf wetness. Try to apply within 24 hours of wetting events, but at least allow time for the spray to dry before rain.
	Mycoshield 17W	0.75 lb			
	or				
	FireLine 17W	0.75 lb			Oxytetracycline rates are based on use of 100 gal water per acre. Concentration, which is based on volume of water, should be 150 ppm. See label for more information.
	or		+++	phytotoxicity concerns restrict copper uses to the recommended rates & phonologies	COPPER PRODUCTS CAUSE LEAF SPOTTING. USE ONLY WHEN DRYING CONDITIONS ARE EXCELLENT.
	<i>Coppers</i> MOA M1				
	(% metallic copper equivalent=MCE)				
	<i>copper ammonium complex</i>				
	Copper-Count-N (8% MCE)	1.6-2.1 pints/100 gal			
	or	(0.15-0.2 lb MCE)			
<i>copper hydroxide</i>					
Kocide 2000 (35% MCE)	0.4-0.6 lb/100 gal				
or	(0.15-0.2 lb MCE)				
Kocide 3000 (30% MCE)	0.5 lb/100 gal				
or	(0.15 lb MCE)		12 hr/ do not apply within 3 weeks of harvest	IF USED AFTER PETAL FALL, COPPERS SHOULD BE ALTERNATED WITH OXYTETRACYCLINE (FireLine or Mycoshield) OR when disease pressure is high, use as a tank-mix of these two materials.	
<i>copper oxychloride plus copper hydroxide</i>			48 hr/ do not apply within 3 weeks of harvest	Copper products are pH sensitive. Coppers applied in spray tank water with pH less than 6.5 may produce damaging phytotoxicity.	
Badge SC (20% MCE)	0.5-0.7 pints/100 gal		48 hr/ do not apply within 3 weeks of harvest	Plum is on most, but not all, copper labels. Check label before use.	
or	(0.15-0.2 lb MCE)			For Nordox 30/30 this rate is 0.15 lb MCE + 0.15 lb MZE	
<i>cuprous oxide</i>				Kocide 3000-O, Nordox 75WG, and Nordox 30/30WG have “organic use (OMRI) status”.	
Nordox 75WG (75% MCE)	0.2-0.3 lb/100 gal		12 hr	Regardless of the copper formulation used, the rate of MCE should not exceed 0.25 lb MCE /acre , preferably in 100 gal. If mild foliar injury occurs, use lower rates. If injury is deemed unacceptable, do not use copper.	
or	(0.15-0.2 lb MCE)			Minimum retreatment interval is 7 days.	
<i>cuprous oxide + zinc oxide</i>				Coppers are concentration-sensitive materials. Rates are typically expressed as amount of formulated copper product/100 gal/acre. If gal sprayed/acre are reduced after shuck split/shuck off, it is important to reduce copper rates/concentrations proportionately, otherwise phytotoxicity is likely to increase.	
Nordox 30/30 WG (30% MCE + 30% MZE)	0.5-0.7 lb/100 gal		12 hr		
	(0.15-0.2 lb MCE+MZE)				

SHUCK SPLIT TO 10% SHUCK OFF COVER SPRAY (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks	
Scab	sulfur <i>MOA M2</i>	9-12 lb	++	24 hr/0 days	Shuck split is a critical time for scab control.	
	or <i>chlorothalonil</i> <i>MOA M5</i>		+++++	12 hr/do not apply after shuck split	<p>Chlorothalonil and captan are severe eye irritants. Although the restricted-entry interval expires after 12 hours, for 7 days after use, entry is permitted only when the following safety measures are provided.</p> <p>(1) At least one container designed specifically for flushing eyes must be available in operating condition at the mandatory WPS-required decontamination site.</p> <p>(2) Workers must be informed, in a manner they can understand:</p> <ul style="list-style-type: none"> • that residues in the treated area may be highly irritating to their eyes. • that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes. • that if they do get residues in their eyes, they should immediately flush their eyes using the eyeflush container that is located at the decontamination site or using other readily available clean water. • how to operate the eyeflush container. <p>Captan 50W rates may be increased to 8 lb/acre for larger trees. Do not exceed 64 lb Captan/acre/season.</p>	
	Bravo Weather Stik (6 lb/gal) or	3-4 pt				
	Bravo Ultrex (0.825 ai/lb) WDG or	2.8-3.8 lb				
	Equus 720 (6 lb/gal) or ECHO 720 or <i>captan</i> <i>MOA M4</i>	3.1-4.1 pt		++++		24 hr/0 days
Captan 50W or 80WDG or Captec 4L	4-6 lb 2.5-3.75 lb 2-3 qt					
	<i>Pydiflumetofen</i> <i>MOA 7</i> Miravis	5.1 fl oz	+++++	4 hr/0 days	Do not use any FRAC 7, 11, or 3 product more than four times per season	
Plant bugs Oriental fruit moth Plum curculio	<i>Organophosphate</i> <i>phosmet</i> <i>MOA 1B</i> Imidan 70W	2-2.5 lb	++++	4 days/14 days for peach & nectarine, 7 days/7 days for plum (14 days for hand harvesting)	<p> Do not apply any insecticide when bees are foraging on the orchard floor.</p> <p>Imidan, Actara, Belay and Avaunt provide excellent control and good residual control of plum curculio. Rotation of Imidan, Actara, Belay or Avaunt with pyrethroids should help protect the resistance-prone pyrethroid class.</p> <p>Imidan efficacy may be reduced in spray solutions of pH 7 or higher. Buffering or acidifying agents are recommended as needed.</p> <p>Imidan provides excellent control of plum curculio and oriental fruit moth. It is only fair against plant bugs and stink bugs. At commonly used rates, Imidan does not adequately suppress scale or lesser peachtree borers.</p> <p>If not in fully enclosed protective cabs, mixers, loaders and airblast applicators must wear coveralls, chemical resistant gloves & footwear, and an approved respirator. Airblast applicators must also wear chemical resistant headgear.</p>	

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SHUCK SPLIT TO 10% SHUCK OFF COVER SPRAY (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Plant bugs Oriental fruit moth Plum curculio (continued)	<i>Neonicotinoids</i> <i>MOA 4A</i>				 Do not apply any insecticide when bees are foraging on the orchard floor.
	<i>thiamethoxam</i> Actara 25WP	4.5-5.5 oz	++++	12 hr/14 days	Actara and Belay are effective, reduced risk, organophosphate replacements. They have a good worker safety profile. When tank mixed with pyrethroids, they are the best option for stink bugs.
	<i>clothianidin</i> Belay 2.1EC	6 fl oz	++++	12 hr/21 days	
	<i>Diamide</i> <i>MOA 28</i>				The diamides are most effective on Lepidopteran larvae, such as oriental fruit moth. There is some contact activity, with exposed insects becoming paralyzed and dying within 1-3 days. More effective when treated plant material is consumed.
	<i>chlorantraniliprole</i> Altacor 35WDG	3-4.5 oz	+++	4 hr/10 days	
	<i>cyantraniliprole</i> Exirel	10-20.5 oz	+++	12 hr/3 days	
	<i>cyclaniliprole</i> Verdepryn 100SL	5.5-11 fl oz	+++	4 hr/7 days	
	<i>Mix</i> <i>MOA 4A + 28</i> <i>thiamethoxam +</i> <i>chlorantraniliprole</i> Voliam Flexi	6-7 oz	+++	12 hr/14 days	Note that Voliam Flexi is a pre-mixed product that contains groups 4A and 28.
	<i>Na channel blocker</i> <i>MOA 22A</i> <i>indoxacarb</i> Avaunt	5-6 oz	++++	12 hr/14 days	Avaunt is an effective, reduced risk, organophosphate replacement with a good worker safety profile.
	<i>Pyrethroids</i> <i>MOA 3A</i> <i>esfenvalerate</i> Asana XL	2-5.8 fl oz	+++	12 hr/14 days	Higher pyrethroid rates are required beginning at shuck split, as plum curculio, borers and stink bugs will typically be more damaging from then through harvest.
	<i>beta cyfluthrin</i> Baythroid XL 1EC	2.8 fl oz	++++	12 hr/7 days	Baythroid or Mustang Maxx, tank mixed with Belay or Actara are our best consistent plant bug and stink bug control options.
	<i>zeta cypermethrin</i> Mustang Maxx	3.8-4.3 fl oz	++++	12 hr/14 days	
	<i>cyfluthrin</i> Tombstone 2EC	2.8 fl oz	++++	12 hr/7 days	
	<i>lambda cyhalothrin</i> Lambda-T 1/EC (encapsulated) or Silencer 1/EC or Warrior II	5 fl oz 5 fl oz 1.28-2.56 fl oz	++++	24 hr/14 days	Lambda-T and Warrior II are encapsulated products, see label for mixing instructions.
	<i>permethrin</i> Pounce 25WP (peach & nectarine)	16 oz	+++	12 hr/14 days	Note: High-rate use of pyrethroids as lesser peachtree borer moth capture begins to increase rapidly (April through early May in central GA & SC's Ridge production areas) seems to suppress LPTB.

7 to 10 DAYS AFTER SHUCK SPLIT COVER SPRAY, if dry, interval may extend to 14 days for scab and insects.

ANTHRACNOSE— Anthracnose control is improved with programs that use chlorothalonil (cannot be used after shuck split), followed by captan. **MOA 11 products** such as Pristine, Merivon, Luna Sensation and Abound may be used later in the season during high disease pressure. **However, MOA 11 products are subject to rapid resistance development** and on two occasions yield loss due to resistance to Pristine, Merivon, Luna Sensation, and Topsin M has been observed in SC. If using MOA 11 products, make sure to alternate with Inspire Super plus Tilt for anthracnose control and do not use **MOA 11 products** for late-season brown rot as well. **It is generally recommended that the MOA 11 products be reserved for late-season, pre-harvest brown rot control. In blocks with a history of anthracnose, start sprays at least 6 weeks prior to harvest.** If anthracnose becomes a problem despite best management efforts, contact Dr. Guido Schnabel for free resistance testing.

GREEN FRUIT ROT—Green fruit rot, the summer phase of brown rot, is uncommon. **When present, green fruit rot dramatically increases risk of heavy pre-harvest brown rot pressure.** Frequent summer rains, especially with the presence of twig cankers, blossom blight, cold cracking of fruit, hail, etc., increase risk and may require treatment for green fruit rot. **If inoculum is present during green fruit stage and long wetness periods occur (30 hours plus), infections are likely to develop.** Buttoned fruit should be regularly checked for rot symptoms. **Shift from sulfur-based programs to captan after 30 hours of continuous wetness. Again, it is recommended that the MOA 11 fungicides be reserved for late-season pre-harvest sprays, if they are used during cover sprays, it is very important to rotate captan with MOA 7 and 11 and to minimize use of these products in pre-harvest brown rot sprays. In orchards thinned after pit hardening, monitor fruit on the ground to indicate the severity of brown rot pressure.** Rot on buttons or thinned fruit on the ground suggests heavy brown rot pressure, adjust cover sprays or initiate pre-harvest brown rot sprays early when disease pressure is high.

GUMMOSIS—Captan is the fungicide of choice for suppression of gummosis.

RED SPOT & SOOTY PEACH—During wet, humid seasons, red spot and/or sooty peach can be damaging in mid- or late-season peaches. **In blocks with a history of red spot or sooty peach, ziram sprays should begin in mid-May. Repeat at 14-day intervals for 3 sprays on mid-season varieties or 4 sprays on late-season varieties.** Ziram does not control scab or green fruit rot. Heavy thrips infestations or high spring winds may increase severity of sooty peach.

LESSER PEACHTREE BORER (LPTB) is a debilitating tree-attacking pest. LPTB larvae attack the inner bark of all structural (weight-bearing) wood. Orchards heavily infested by LPTB suffer reduced fruit size and yield, with premature tree decline and death. Established LPTB controls are preventative. Curative application of entomopathogenic nematodes have shown promise on established LPTB and PTB infestations when used with an appropriate anti-desiccant to keep the borer wounds moist long enough for the nematodes to find larvae. Middle GA growers interested in on-farm trials should contact their county agent and fruit entomologist. In middle GA, LPTB moths lay eggs from April into November. LPTB larval establishment is closely tied to wounded bark. LPTB infestations are much more severe where sunburn, cold injury to the undersides of scaffolds, scale, limb breaks, propping or tying wounds, large, rough pruning cuts, disease cankers, or where existing LPTB wounds are present. LPTB moths do not glue their eggs in place. Smooth healthy bark and well-healed pruning cuts at the origin of limbs are less prone to LPTB larval infestations. **The most effective LPTB control programs rely on a combination of preventative insecticide sprays for LPTB applied pre-bloom followed by aggressive full-season cover spray programs. Use of high-rate pyrethroid applications during April - May in central GA and SC's Ridge, is an important component of LPTB management.** These sprays for do not necessarily provide peachtree borer control.

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Red spot Sooty peach	<i>ziram</i> <i>MOA M3</i> Ziram 76DF	4 lb	+++	48 hr/14 days	Red spot and sooty peach are often variety- or block-specific problems. Control is strictly preventative. In central GA, sprays should begin in May. Apply as needed 3 to 4 times. Sooty peach is more of a problem where mites, aphids, scales, thrips, blowing sand or other conditions result in abrasion to the fruit surface and accumulation of fruit juices on the surface of peach. Ziram does not control scab or green fruit rot.
Bacterial spot	<i>oxytetracycline</i> <i>MOA 41</i> Mycoshield 17W or FireLine 17W	0.75 lb 0.75 lb	++	12 hr/21 days	Oxytetracycline is most effective when applied shortly before rain or extended periods of leaf wetness. Try to apply within 24 hours prior to wetting event, but at least allow time for the spray to dry. Rate is based on use of 100 gal water per acre. Concentration, which is based on volume of water, should be 150 ppm.

(continued on next page)

7 to 10 DAYS AFTER SHUCK SPLIT COVER SPRAY (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Bacterial spot (continued)	<p><i>Coppers</i> <i>MOA M1</i> (% metallic copper equivalent=MCE)</p> <p><i>copper ammonium complex</i> Copper-Count-N (8% MCE) or</p> <p>Kocide 2000 (35% MCE) or</p> <p>Kocide 3000 (30% MCE) or</p> <p><i>copper oxychloride plus copper hydroxide</i> Badge SC (20% MCE) or</p> <p><i>cuprous oxide</i> Nordox 75WG (75% MCE) or</p> <p><i>cuprous oxide + zinc oxide</i> Nordox 30/30 WG (30% MCE + 30% MZE)</p>	<p>0.5-1.6 pints/100 gal (0.05-0.15 lb MCE)</p> <p>0.14-0.43 lb/100 gal (0.05-0.15 lb MCE)</p> <p>0.17-0.5 lb/100 gal (0.05-0.15 lb MCE)</p> <p>0.2-0.5 pints/100 gal (0.05-0.15 lb MCE)</p> <p>0.07-0.20 lb/100 gal (0.05-0.15 lb MCE)</p> <p>0.17-0.5 lb/100 gal (0.05-0.15 lb MCE+MZE)</p>	+++	<p>phytotoxicity concerns restrict copper uses to the recommended rates & phenologies</p> <p>12 hr/ do not apply within 3 weeks of harvest</p> <p>48 hr/ do not apply within 3 weeks of harvest</p> <p>48 hr/ do not apply within 3 weeks of harvest</p> <p>48 hr/ do not apply within 3 weeks of harvest</p> <p>12 hr</p> <p>12 hr</p>	<p>If coppers are used in summer cover sprays, always alternate with oxytetracycline, as alternating these materials reduces the risk of resistance.</p> <p>Copper products are pH sensitive. Coppers applied in spray tank water with pH less than 6.5 are likely to produce phytotoxicity.</p> <p>Plum is on most, but not all, copper labels. Check label before use.</p> <p>Minimum retreatment interval is 7 days.</p> <p>Regardless of the copper formulation used, the rate of MCE should not exceed 0.15 lb (2.4 oz) MCE /acre, preferably in 100 gal. If mild foliar injury occurs, use lower rates. If injury is deemed unacceptable, do not use copper.</p> <p>Coppers are concentration-sensitive materials. Rates are typically expressed as amount of formulated copper product/100 gal/acre. If gal sprayed/acre are reduced after shuck split/shuck off, it is important to reduce copper rates proportionately, otherwise phytotoxicity is likely to increase. Phytotoxicity is a risk when used during cover sprays, but use of very low rates of a Copper-Count-N or Kocide 3000 can be effective against bacterial spot. Apply when drying conditions are good to excellent.</p> <p>Kocide 3000 is labeled for post-bloom use for a maximum of 6 applications. Spotting and defoliation may occur. Discontinue use if injury occurs. Kocide 3000 can be tank-mixed with oxytetracycline (Fireline).</p> <p>For Nordox 30/30 this rate is 0.075 lb MCE + 0.075 lb MZE</p> <p>Kocide 3000-O, Nordox 75WG, and Nordox 30/30WG have “organic use (OMRI) status”.</p>
Scab (continued on next page)	sulfur <i>MOA M2</i> or	9-12 lb	+++	24 hr/0 days	The addition of thiophanate-methyl at 1.25 lb/acre can enhance scab control. If thiophanate-methyl is used here, it should only be used once and not in other earlier or later sprays because of potential for resistance.

7 to 10 DAYS AFTER SHUCK SPLIT COVER SPRAY (continued)

Pest(s)	Material(s)	Formulated product/acre	Effectiveness	REI/PHI	Remarks
Plum curculio Plant bugs Oriental fruit moth Lesser peachtree borer (suppression) (continued)	<i>Pyrethroids</i> MOA 3A <i>esfenvalerate</i> Asana XL	2-5.8 fl oz	+++	12 hr/14 days	High pyrethroid rates are necessary after shuck split when plum curculio, borers and stink bugs are more abundant. Oriental fruit moth is easily controlled in southeastern peaches with Imidan or pyrethroids at petal fall, shuck split and shuck off sprays, which also control other early season pests. Oriental fruit moth seldom reaches damaging levels in the coastal plain areas of SC, GA, or FL. Strategic, high-rate use of pyrethroids should be made as lesser peachtree borer moth capture begins to increase rapidly, April through early May in central GA & SC's Ridge production areas. Endigo or tank mixes of Actara or Belay plus pyrethroids are our most consistent stink bug materials. Lambda-T and Warrior II are encapsulated products, see label for mixing instructions.
	<i>beta cyfluthrin</i> Baythroid XL 1EC	2.8 fl oz	++++	12 hr/7 days	
	<i>zeta cypermethrin</i> Mustang Maxx	1.3-4.3 fl oz	++++	12 hr/14 days	
	<i>cyfluthrin</i> Tombstone 2EC	2 fl oz	++++	12 hr/7 days	
	<i>lambda cyhalothrin</i> Lambda-T 1EC or Silencer 1EC or Warrior II	4 fl oz 4 fl oz 1.28-2.56 fl oz	++++	24 hr/14 days	
	<i>permethrin</i> Ambush 25W (peach only) Pounce 25WP (peach & nectarine)	19 oz 16 oz	+++	12 hr/14 days	
Scale insects (continued on next page)	<i>pyriproxifen</i> MOA 7C Esteem 35WP	4-5 oz	++++	12 hr/14 days	Centaur or Esteem or Movento applied as crawlers emerge provide excellent control.
	<i>buprofezin</i> MOA 16 Centaur 70W	34.5 oz	++++	12 hr/14 days	Centaur is labeled for use on peaches, nectarines and plums.

7 to 10 DAYS AFTER SHUCK SPLIT COVER SPRAY (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Stink bugs (continued)	<i>lambda cyhalothrin</i> MOA 3A Lambda-T 1EC or Silencer 1EC or Warrior II	4 fl oz 4 fl oz 1.28-2.56 fl oz		24 hr/14 days	
Weed Management Apply PRE + POST herbicides	See herbicide product list	Numerous options and combinations. See product list or label.	+++++		Apply herbicides as-needed when effects from fall herbicide application diminish, and emerging weeds are 2 to 3” tall. Delaying PRE herbicide application until first few weeks in May (if a fall PRE herbicide was applied) will result in extended residual weed control into the mid and late summer.

SUMMER COVER SPRAYS—14 day intervals are standard, may vary from 7-21 days depending on pest pressure/conditions.

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Weed Management Bermudagrass or Johnsongrass (May)	Fusilade DX or Poast 1.5EC or Select Max	12 to 24 oz 1.5 pt 16 oz	+++++ ++++ +++++	12 hr/14 days 12 hr/25 days 24 hr/14 days	Apply to actively growing weeds. Bermudagrass should have 4-8” long runners when applied. Johnsongrass should be 8-18” tall when using Fusilade and 25” tall when using Poast. Bearing plums cannot be treated with Poast or Select Max.
Weed Management Escaped Weeds (June-Aug)	<i>paraquat</i> plus surfactant or <i>glufosinate</i> + <i>ammonium sulfate</i> or Embed or <i>glufosinate</i> + Embed + ammonium sulfate	dependent upon formulation or 32 to 48 fl. oz or 1 qt	++++	24 hr/28 days plums/nectarine 24 hr/14 days peach	Research indicates weed populations 4-8 weeks prior to harvest can reduce fruit size and marketable yield. Paraquat and glufosinate are POST non-selective. See labels or herbicide efficacy chart in herbicide section for susceptible species. Glufosinate tank mixed with Embed (2,4-D choline) 0.5 to 1 qt/A will provide broadspectrum control of broadleaf weeds including Palmer amaranth and morningglory species.

SUMMER COVER SPRAYS (continued)

BACTERIAL SPOT—Sprays are critical from mid-May to early June to prevent large fruit lesions. Although less evident, bacterial spot infections may continue through harvest. Small bacterial spot lesions increase susceptibility to brown rot, and failure to control can result in significantly more brown rot.

ANTHRACNOSE— Captan generally provides effective anthracnose control; whenever possible, reserve the use of MOA 11 products for pre-harvest brown rot management. MOA 11 products are subject to rapid resistance development. If using Abound or Pristine, Merivon or Luna Sensation for green fruit rot or anthracnose, follow resistance management guidelines by not subsequently using QoIs for late season brown rot. Recent research results show that the combination of Inspire Super plus Tilt provides anthracnose control similar to MOA 11 products. Rotating this mixture with captan and MOA 11 products is recommended.

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Bacterial spot	as-needed				
	<i>oxytetracycline</i> MOA 41		++	12 hr/21 days	Moisture is very conducive to bacterial spot infection. Unfortunately, oxytetracycline's (Mycoshield or FireLine) residual is short. Oxytetracycline must be sprayed when infection is occurring or it does no good. Either spray on a 5-7 day schedule or use the predictive model. Thorough coverage is very important to achieve good bacterial spot control. Do not use oxytetracycline within 21 days of harvest.
	Mycoshield 17W or FireLine 17W	0.75 lb 0.75 lb			Rate is based on use of 100 gal water per acre. Concentration, which is based on volume of water, should be 150 ppm. See label for more information.
	or <i>Coppers</i> MOA M1 (% metallic copper equivalent=MCE) <i>copper hydroxide</i>		+++	phytotoxicity concerns restrict copper uses to the recommended rates & phenologies	If coppers are used in summer cover sprays, always alternate with oxytetracycline, as alternating these materials reduces the risk of resistance. Copper products are pH sensitive. Coppers applied in spray tank water with pH less than 6.5 are likely to produce phytotoxicity.
	Kocide 3000 (30% MCE) or <i>copper oxychloride plus copper hydroxide</i> Badge SC (20% MCE)	0.17-0.5 lb/ 100 gal (0.05-0.15 lb MCE) 0.2-0.5 pts/100 gal (0.05-0.15 lb MCE)		48 hr/ do not apply within 3 weeks of harvest	Regardless of the copper formulation used, the rate of MCE should not exceed 0.15 lb (2.4 oz) MCE /acre, preferably in 100 gal. If mild foliar injury occurs, use lower rates. If injury is deemed unacceptable, do not use copper. Plum is most, but not all, copper labels. Check label before use.
			+++	48 hr/ do not apply within 3 weeks of harvest	Phytotoxicity is a risk , but use of very low rates of Copper-Count-N, Kocide 2000, or Kocide 3000 can be effective against bacterial spot. Phytotoxicity to leaves may occur with the use of copper in cover sprays. Apply when drying conditions are good to excellent. Copper-Count-N can be applied in 1st and 2nd cover sprays but not closer than 3 weeks of harvest. Kocide 3000 can be used in a maximum of 6 post-bloom sprays. Spotting and defoliation may occur. Discontinue use if injury occurs. Kocide 3000 can be tank-mixed with oxytetracycline (Fireline). Coppers are concentration-sensitive materials. Rates are typically expressed as amount of formulated copper product/100 gal/acre. If gal sprayed/acre are reduced after shuck split/shuck off, it is important to reduce copper rates proportionately, otherwise phytotoxicity is likely to increase.

SUMMER COVER SPRAYS (continued)

PLUM CURCULIO—In middle GA and SC’s Ridge area, overwintered or first generation plum curculio may be present from petal fall through late April. Second generation plum curculio pressure in those production areas may be seen from late May into July.

SCALE CRAWLERS—Scale have multiple generations. Scale control failures that result in fruit marred by red spots are becoming more common. Frequent, detailed observation is the key to seeing control breaks begin. When crawlers are actively moving, dilute application of Esteem or Centaur, ideally tank mixed with 3.5 lb of Imidan, is the optimal treatment. Imidan’s maximum seasonal application limit is 17 lb 70W.

ORIENTAL FRUIT MOTH—Pheromone traps may be used to monitor for OFM populations. In middle GA, varieties later than Harvester are occasionally subject to fruit damage by OFM. OFM is seldom a problem in GA’s lower coastal plain or in north FL.

STINK BUGS, FULLER ROSE WEEVILS, GRASSHOPPERS, JAPANESE BEETLES, JUNE BEETLES, etc.—Frequent observation is needed to assess the damage potential from occasional fruit pests. All fruit feeders can spread pre-harvest brown rot, especially in wet weather. June beetles are most damaging in the O’Henry–Flameprince season.

PICNIC and SAP BEETLES, which are nearly always present in dropped fruit on the orchard floor, can become so abundant they move up into the tree to attack sound fruit. If they move to ripening fruit they can be very difficult to control after mid- to late-June. Rimon, an insect growth regulator, if applied at 14-day intervals tank-mixed with full rate of Imidan, is the best control option. Sap beetle populations in drops on the orchard floor will sometimes grow very rapidly, this has been observed from mid-June into August. **Control of fruit-attacking sap beetles with this tank mix is much less effective or ineffective once sap beetles have begun to attack sound fruit on the tree.** Neonicotinoids (Actara, Belay or imidacloprid) do not control picnic beetles. In blocks with a history of picnic and/or sap beetle injury, do not use neonicotinoids in the last two pre-harvest sprays without a full rate tank mix of Imidan.

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Scab Scab and Green fruit rot	sulfur <i>MOA M2</i> or	9-12 lb	+++	24 hr/0 days	Sulfur will only control scab.
	<i>captan</i> <i>MOA M4</i> Captan 50W or 80WDG or Captec 4L	4-6 lb 2.5-3.75 lb 2-3 qt	++++	24 hr/0 days	Captan products provide enhanced scab and green fruit rot control. Captan is a severe eye irritant. Although the restricted-entry interval expires after 12 hours, for 7 days after use, entry is permitted only when the following safety measures are provided. (1) At least one container designed specifically for flushing eyes must be available in operating condition at the mandatory WPS-required decontamination site. (2) Workers must be informed, in a manner they can understand: <ul style="list-style-type: none"> that residues in the treated area may be highly irritating to their eyes. that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes. that if they do get residues in their eyes, they should immediately flush their eyes using the eyeflush container that is located at the decontamination site or using other readily available clean water. how to operate the eyeflush container.
<i>(continued on next page)</i>					

SUMMER COVER SPRAYS (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Scab Scab and Green fruit rot (continued)	sulfur <i>MOA M2</i>	9-12 lb	+++	24 hr/0 days	Sulfur will only control scab.
	or <i>captan</i> <i>MOA M4</i> Captan 50W or 80WDG or Captec 4L	4-6 lb 2.5-3.75 lb 2-3 qt	++++	24 hr/0 days	<p>Captan products provide enhanced scab and green fruit rot control.</p> <p>Captan is a severe eye irritant. Although the restricted-entry interval expires after 12 hours, for 7 days after use, entry is permitted only when the following safety measures are provided.</p> <p>(1) At least one container designed specifically for flushing eyes must be available in operating condition at the mandatory WPS-required decontamination site.</p> <p>(2) Workers must be informed, in a manner they can understand:</p> <ul style="list-style-type: none"> • that residues in the treated area may be highly irritating to their eyes. • that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes. • that if they do get residues in their eyes, they should immediately flush their eyes using the eyeflush container that is located at the decontamination site or using other readily available clean water. • how to operate the eyeflush container.
Anthracnose	<i>captan</i> <i>MOA M4</i> Captan 50W or 80WDG or Captec4L	4-6 lb 2.5-3.75 lb 2-3 qt	+++	24 hr/0 days	If your farm, or particular blocks, has a history of anthracnose, apply captan cover sprays during extended periods of wet weather.
	<i>difenoconazole</i> <i>MOA 3</i> plus <i>cyprodinil</i> <i>MOA 9</i> Inspire Super plus <i>propiconazole</i> <i>MOA 3</i> Tilt	16 to 20 fl oz 4 fl oz	+++	12 hr/2 days	

SUMMER COVER SPRAYS (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Plant bugs Stink bugs Oriental fruit moth Plum curculio Lesser peachtree borer (suppression)	<i>Organophosphate</i> <i>phosmet</i> <i>MOA 1B</i> Imidan 70W	2-4 lb	++++	4 days/14 days for peach & nectarine, 7 days/14 days for plum	Do not apply any insecticide when bees are foraging on the orchard floor. Imidan, Actara, Belay and Avaunt provide good residual control of plum curculio. Rotation of Imidan, Actara, Belay or Avaunt with pyrethroids should help protect the resistance-prone pyrethroid class. Imidan provides very good control of plum curculio, sap beetles and oriental fruit moth. If not in fully enclosed protective cabs, mixers, loaders and airblast applicators must wear coveralls, chemical resistant gloves & footwear, and an approved respirator. Airblast applicators must also wear chemical resistant headgear.
	<i>Neonicotinoids</i> <i>MOA 4A</i> <i>thiamethoxam</i> Actara 25WP	4.5-5.5 oz	++++	12 hr/14 days	Tank mixes of either Actara or Belay plus pyrethroids are the best options for stink bug control. Actara and Belay are both limited to 2 applications per season.
	<i>clothianidin</i> Belay 2.1EC	6 fl oz	++++	12 hr/21 days	Actara and Belay have very desirable worker safety profiles, accordingly, they are good choices during thinning. Note: neither Actara nor Belay control picnic beetles.
	<i>Diamide</i> <i>MOA 28</i> <i>chlorantraniliprole</i> Altacor 35WDG	3-4.5 oz	+++	4 hr/10 days	The diamides are most effective on Lepidopteran larvae, such as oriental fruit moth. There is some contact activity, with exposed insects becoming paralyzed and dying within 1-3 days. More effective when treated plant material is consumed.
	<i>cyantraniliprole</i> Exirel	10-20.5 oz	+++	12 hr/3 days	
	<i>cyclaniliprole</i> Verdepryn 100SL	5.5-11 fl oz	+++	4 hr/7 days	
	<i>Na channel blocker</i> <i>MOA 22A</i> <i>indoxacarb</i> Avaunt	5-6 oz	++++	12 hr/14 days	Avaunt is an effective, reduced risk, organophosphate replacement.
	<i>Pyrethroids</i> <i>MOA 3A</i> <i>esfenvalerate</i> Asana XL	2-5.8 fl oz	+++	12 hr/14 days	Pyrethroids are not good stand-alone options for brown stink bug. Tank mixing with Actara or Belay improves stink bug control.
	<i>beta cyfluthrin</i> Baythroid XL 1EC	2 fl oz	++++	12 hr/7 days	
	<i>zeta cypermethrin</i> Mustang Maxx	1.4-4.3 fl oz	++++	12 hr/14 days	
	<i>cyfluthrin</i> Tombstone 2EC	2 fl oz	++++	12 hr/7 days	
	<i>lambda cyhalothrin</i> Lambda-T 1EC or Silencer 1EC or Warrior II	4 fl oz 4 fl oz 1.28-2.56 fl oz	++++ ++++ ++++	24 hr/14 days	Lambda-T and Warrior II are encapsulated products, see label for mixing instructions.

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SUMMER COVER SPRAYS (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Plant bugs Stink bugs Oriental fruit moth Plum curculio Lesser peachtree borer (suppression)	<i>permethrin</i> Ambush 25W (peach only) Pounce 25WP (peach & nectarine)	19 oz 16 oz	+++	12 hr/14 days	Pounce and Ambush (permethrin) are only recommended at the highest rates; permethrin is typically the least effective peach pyrethroid.
<i>(continued)</i>					
Picnic and/or Sap beetles	as-needed <i>Benzoylurea novaluron</i> <i>MOA 15</i> Rimon 0.83EC plus <i>Organophosphate phosmet</i> <i>MOA 1B</i> Imidan 70W	20 fl oz 3-4 lb	++-+++ ++ to +++	12 hr/8 days 3 days/14 days	Apply Rimon + Imidan as-needed when picnic and/or sap beetle numbers on dropped fruit seem to be increasing. Rimon, an insect growth regulator, if applied at 14-day intervals tank-mixed with full rate of Imidan, is the best control option. Sap beetle populations in drops on the orchard floor will sometimes grow very rapidly, this has been observed from mid-June into August. Control of fruit attacking sap beetles with this tank mix is much less effective or ineffective once sap beetles have begun to attack sound fruit on the tree. Neonicotinoids (Actara, Belay or imidacloprid) do not control picnic beetles. In blocks with a history of picnic and/or sap beetle injury, do not use neonicotinoids in the last two pre-harvest sprays without a full rate tank mix of Imidan.

SPIDER MITES—Peaches are more tolerate of moderate mite populations than plums, apples or pears. Twospotted spider mite is the most common mite pest of southeastern peach; but European red mite can also be injurious, especially in the region’s cooler production areas. Treat if mites are quite numerous, for the presence of mites and the on-set of bronzing or webbing or if mites are abundant enough to irritate pickers. **Do not allow mites to cause defoliation, as subsequent sunburn often shortens the life of affected scaffold limbs.** Overcropping, drought and other stresses justify lower treatment thresholds. Pyrethroids (Ambush, Asana, Baythroid, Pounce, Warrior II) and carbamates, such as Sevin, encourage mite outbreaks. Use miticides as-needed. **Do not wait until harvest to address mite problems. Pre-harvest intervals (PHIs) for miticides vary from 28 days down to 3 days. Curative miticides (Acramite, Nexter, Envidor, Agri-Mek) are the materials of choice for most mite problems in peach.** The more effective curative miticides may be applied ARM. If mites are concentrated on sucker leaves in the center of trees, they may be targeted by closing down the top 2-3 nozzles. In rare circumstances, heavy early- to mid-season mite infestations may justify application of Apollo, Savey or Zeal.

Spider mites Twospotted spider mite (primary SE peach mite) or European red mite	<i>bifenazate</i> <i>MOA UN</i> Acramite 50WS	0.75-1 lb	+++++	12 hr/3 days	Acramite is a very good curative miticide, especially against twospotted spider mite. Acramite has provided good control of twospotted spider mite when applied to alternate-row-middles at the 1 lb rate. Acramite is unstable in high pH (alkaline) and/or high carbonate water. Adjust spray tank water with a water conditioner or ammonium sulfate, pH 5.5 is optimal. Acramite has been associated with inking in some production areas. Sprays made close to harvest are more likely to predispose inking of fruit.
	<i>pyridaben</i> <i>MOA 21A</i> Nexter 75WP	4.4-5.2 oz 8.8-10.6 oz	+++++ (European red mite) ++++ (twospotted spider mite)	12 hr/7 days	Nexter is a very reliable, curative miticide. Do not breathe Nexter WP dust or Nexter spray mist. Applicators should not drive back through mist that may linger in the orchard. Loaders and applicators must wear an approved respirator/ goggles or safety glasses with side-shields, long pants and long sleeves, socks and shoes, and waterproof gloves. Wash thoroughly with soap and water after use.
<i>(continued on next page)</i>	<i>spirodiclofen</i> <i>MOA 23</i> Envidor 2SC	16 oz	++++	12 hr/7 days	Envidor is a very good curative miticide. It is more active against eggs and nymphs than adults.

SUMMER COVER SPRAYS (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Spider mites	<i>abamectin</i> MOA 6				
Twospotted spider mite (primary SE peach mite) or European red mite	Agri-Mek 0.15EC	10-20 fl oz	++++	12 hr/21 days	Agri-Mek is a very good curative miticide. Apply Agri-Mek with a non-ionic surfactant spreader sticker at the surfactant-specified rate. Pre-check for potential fruit finish concerns. Agri-Mek also provides a modest level of thrips control.
(continued)	<i>cyhexatin</i> MOA 12B				
	Vendex 50WP	1-2 lb	+++	2 days/14 days	Vendex is an older, generally reliable, curative miticide.
	Preventive miticides				
	<i>clofentezine</i> MOA 10A				
	Apollo 0.42SC	4 oz	++++	12 hr/21 days	Apollo, Savey, and Zeal are preventative miticides in MOA class 10. These products must be applied before mites build up. Apollo, Savey and Zeal control mite eggs and some early immature mite stages; they do not control adult mites. If applied to active mite infestations, mite numbers will not be visibly reduced for around 10 days. They have similar toxic modes of action; do not use a rotation of Apollo, Savey, or Zeal without interspersing a curative miticide.
	<i>hexythiazox</i> MOA 10A				
	Savey 50DF	3 oz	++++	12 hr/28 days	Apollo is labeled for peach and nectarine, but not for plum. Savey is labeled for peach, nectarine and plum.
	<i>etoxazole</i> MOA 10B				
	Zeal 72W	2-3 oz	+++++	12 hr/7 days	

PRE-HARVEST WATER SPROUT REMOVAL (3-4 weeks before harvest, at the beginning of final swell)

Pre-harvest water sprout removal promotes increased fruit size, red fruit color and fruit bud development for next year, especially in the interior canopy. **Break out, or cut if too large to break, water sprouts which are $\geq 45^\circ$ more upright than the scaffold limb they originate from. Retain a few water sprouts to shade the scaffolds, take care to maintain shading of southwest facing scaffolds.** Although the cuts made pre-harvest are smaller than some dormant season cuts, summer cuts produce wounds while lesser peachtree borers are laying eggs. **A high rate pyrethroid insecticide should be applied as soon as feasible after any summer pruning activity.**

PEACH SKIN DISCOLORATION DISORDERS

Peach skin discoloration disorders are variously described as inking, streaking, or spotting. These abnormal brown to black spots or stripes are restricted to the peach skin or the skin and flesh just below the skin. Physical injuries, particularly abrasion, bruising and sun injury, seem to contribute to discoloration. Rainfall and high harvest temperatures have also been associated with skin disorders. When the skin of damaged cells matures, it can release anthocyanin/phenolic pigments that may react with heavy metals, turning the skin brown or purple-to-black. Inking risks associated with abrasion may be compounded by exposure of the fruit to iron-, copper- and aluminum-containing materials, sprayed on the fruit to control pests, applied as foliar nutrients, or as contaminants in hydrocooler or wash water during the period from 3 weeks pre-harvest to end through cooling and packing. Highly colored fruit are more susceptible to discoloration. Packing and cooling processes can contribute significantly to skin discoloration. Hydrocooler management is important. Hydrocoolers with excessive chlorination and pHs under 6.5 are prone to inking. Empty and replenish hydrocooler water daily, or as often as feasible, as dirty cooler water increases the risk of fruit discoloration. Cultivars observed to have repeated skin discoloration problems include, but may not be limited to: Scarletprince, Julyprince and Majestic. Fruit that appear normal may develop symptoms up to 48 hours after hydrocooling or packing. If incidence of skin discoloration is high, attempt to delay shipping to allow detection of skin discoloration before shipping. Onset of discoloration symptoms may be accelerated from roughly 48 hours to as little as 4 hours by placing suspect fruit in an airtight, high humidity container at 110°F.

PEACH SKIN DISCOLORATION DISORDERS (*continued*)

MINIMIZE INKING OR OTHER PEACH SKIN DISCOLORATIONS BY:

1. **HANDLE FRUIT CAREFULLY**—Abrasions sustained during picking, hauling, grading, and packing increase the risk of discoloration. Supervise labor to minimize bruising and abrasion. Keep picking containers and bulk bins clean. Minimize abrasion and bruising during transport by grading field roads and slowing down. Before cooling, keep fruit in shaded areas. Cool as soon as possible. Minimize packing house injury from vibration, rubbing or rolling of fruit.
2. **KEEP HYDROCOOLERS AND DUMP TANKS AS CLEAN** as possible. Flush out hydrocoolers and dump tanks as often as possible, preferably daily, removing dirt, leaves and other debris and refilling with clean water. Excessive iron in treatment water is a common cause of skin discoloration. Rust in hydrocoolers and dump tanks can result in high levels of rust in water, which promotes fruit discoloration. Keeping pH levels above 6.5 helps minimize risk of iron-related inking.
3. **MAINTAIN DUMP TANK/HYDROCOOLER CHLORINE LEVELS OF 25-50 PPM @ pH 6.5-7.5.** To raise pH use Decco 239 or pH Rise; to lower pH use Decco 312 Buffer. At a pH above 6.5 iron-related inking risks are dramatically reduced. If you have pH problems, use “labeled for food-contact” chlorine that contains calcium hypochlorite, such as DryTec. **Water in the pH 4-6 range is prone to discoloration.** At a pH less than 5.2, iron exists in a soluble, discoloration-prone ferrous state (Fe+2). The use of high-grade swimming pool chlorine is unacceptable in dump tanks and hydrocoolers unless it is also labeled for food contact.
4. **WASH ROLLERS BEFORE USE**—Polyurethane rollers are superior to latex rollers. Thoroughly wash rollers, particularly latex ones, in detergent before mounting. In addition, run several small lots of fruit over the rollers before heavy use of the line. Packing line abrasion from wet brushing, and particularly from drying with latex rollers, seems especially problematic.
5. **AVOID EXPOSURE TO AMMONIA AND SULFUR DIOXIDE**—Fruit are quite susceptible to skin discoloration if exposed to ammonia (NH₃), and/or sulfur dioxide (SO₂) gases.

In orchards where skin disorders are suspected or seen, delay packing for ca. 48 hours so fruit with skin disorders can be culled before packaging.

PRE-HARVEST—Pre-harvest fungicides are typically applied 14 days before harvest and again 7 days before harvest. When brown rot pressure is severe, fungicides may be needed at 21-, 14-, 7-days before harvest and just before or during harvest.

BROWN ROT— Good pre-harvest fungicide programs are essential. Brown rot very readily develops resistance to fungicides with site-specific MOA. The most practical approach to resistance management is alternating multiple fungicide classes in a well considered fashion to avoid repetitive exposure of the fungus to the same mode of action. Brown rot fungus has documented resistance to MOA code 1 fungicides (Topsin-M), but recent research shows resistance is no longer widespread. Brown rot isolates from some Georgia and South Carolina orchards have developed modest levels of resistance to MOA FRAC code 3 fungicides [propiconazole (Tilt/Propimax), fenbuconazole (Indar), tebuconazole (Orius), mefentrifluconazole (Cevya) and MOA FRAC code 3 generics]. Resistance to MOA code 3 brings a gradual loss of effectiveness. Even though incipient resistance has begun to develop, the MOA code 3 fungicides remain vitally important to good brown rot control **and resistant strains can be controlled with higher rates of Indar, Cevya, or Orius.** MOA code 11 fungicide azoxystrobin (Abound) and Pristine, a pre-mixed combination material of MOA code 11 pyraclostrobin plus MOA code 7 boscalid and Merivon and Luna Sensation (similar to Pristine but contain different FRAC 7 and 11 products) are also key pre-harvest brown rot fungicides. Boscalid, fluxapyroxad, and penthiopyrad (Fontelis) are MOA code 7 products with excellent efficacy against brown rot. Field resistance to MOA code 7 and 11 products can occur, but so far only one case of reduced sensitivity has been reported that was connected with loss of field performance in one SC orchard. Outlined below are the pre-harvest fungicides recommended to slow development of fungicide-resistant brown rot strains while still providing effective brown-rot control under varying orchard conditions.

If brown rot is observed despite following our recommendations, you may take advantage of a resistance management service that detects failing fungicides. A Clemson University/University of Georgia extension program can identify the most effective spray program for brown rot control for your operation based on resistance profile. Such information counteracts selection for fungicide resistance, making disease management and your operation more sustainable for the future. The program determines the sensitivity of the local *Monilinia* population to the most commonly used fungicide classes for brown rot management: MOA code 1 products (e.g., Topsin M), MOA code 3 products (e.g., Bumper, Propistar), and MOA code 7 and 11 products (Abound, Pristine, Luna Sensation, Merivon). Here is how it works: The pathogen is collected once or twice a year from multiple farm locations and subjected to specific discriminatory doses of fungicides in a poison agar assay. After three days of incubation, the ability of the fungus to grow on fungicide-amended growth medium is assessed. If the fungus grows on fungicide-amended medium, it is considered resistant. The resistance profile may change from one season to another depending on the spray history. For Georgia and South Carolina growers this service can be conducted in research labs or may already be provided at local plant problem clinics. For more information contact Guido Schnabel; schnabe@clemson.edu.

PRE-HARVEST (continued)

Pre-harvest fungicide use-pattern for low brown rot pressure (relatively dry season with limited or no blossom blight or green fruit rot)

Brown rot

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
21 days pre-harvest	<p><i>captan</i> MOA M4 Captan 50W or Captec 4L or</p> <p><i>azoxystrobin</i> MOA 11 plus <i>thiophanate-methyl</i> MOA 1 Abound 2.08F plus Topsin-M 70W,WSB,WDG</p>	<p>5-8 lb 2.5-4 qt</p> <p>10 fl oz plus 0.75 lb</p>	<p>+++</p> <p>++++</p>	<p>24 hr/0 days</p> <p>4 hr/0 days</p> <p>2 days/1 day</p>	<p>Captan use is sometimes associated with inking and other skin discolorations when applied pre-harvest during wet, slow drying conditions. Skin discoloration is less likely to occur if captan use ceases 40 days before harvest. Risk of captan associated inking is greatest within 20 days of harvest. Refer to the Inking section.</p> <p>Captan is a severe eye irritant. Although the restricted-entry interval expires after 12 hours, for 7 days after use, entry is permitted only when the following safety measures are provided.</p> <p>(1) At least one container designed specifically for flushing eyes must be available in operating condition at the mandatory WPS-required decontamination site.</p> <p>(2) Workers must be informed, in a manner they can understand:</p> <ul style="list-style-type: none"> • that residues in the treated area may be highly irritating to their eyes. • that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes. • that if they do get residues in their eyes, they should immediately flush their eyes using the eyeflush container that is located at the decontamination site or using other readily available clean water. • how to operate the eyeflush container. <p>Where fruit skin discoloration is a concern, the Abound plus Topsin-M tank-mix in this 21-day pre-harvest application may be an option for orchards that do not have a history of MBC resistance.</p> <p>Do not use Abound in sprayers that will be used for apples. Re-entry and pre-harvest intervals for Abound & Topsin-M tank mixes are bound by the more cautious Topsin-M Intervals (2-days/1-day). Use Topsin-M only once a year. If you have used it already during bloom, do not use it again pre-harvest.</p> <p>The fungicide Protocol (premixture of thiophanate methyl plus propiconazole) is registered for brown rot control but not listed because resistance to both components is present in the Southeast and we want to avoid selection of dual-resistant isolates.</p> <p>Quadris Top (difenoconazole (FRAC 3) plus azoxystrobin (FRAC 11)) premixture is registered but not listed for brown rot control to avoid unnecessary selection for FRAC 11 fungicide resistance in anthracnose fungi during pre-harvest sprays (FRAC 11s are already used in 7 and 11 combinations and should not also be used in combination with FRAC 3s when rotating).</p>

PRE-HARVEST (continued)

Pre-harvest fungicide use-pattern for low brown rot pressure (relatively dry season with limited or no blossom blight or green fruit rot) (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
1-7 days pre-harvest (continued)	<i>difenoconazole</i> MOA 3 plus <i>cyprodinil</i> MOA 9 Inspire Super	16-20 fl oz	+++++	12 hr/2 days	

PRE-HARVEST (continued)

Pre-harvest fungicide use-pattern for moderate to heavy brown rot pressure (normal to high moisture season with possible blossom blight and/or green fruit rot and possible fungicide resistance issues)

21 days pre-harvest	<i>pyraclostrobin</i> MOA 11 plus <i>boscalid</i> MOA 7 Pristine 38W or <i>pyraclostrobin</i> MOA 11 plus <i>fluxapyroxad</i> MOA 7 Merivon	10.5-14.5 oz	+++++	12 hr/0 days	Under certain conditions, mixtures of Merivon with adjuvants, additives and/or other products may cause crop injury, particularly to fruit within two weeks of harvest. DO NOT use Merivon with: emulsifiable concentrate (EC) or solvent-based formulation products. • Crop oil concentrate (COC), methylated seed oil (MSO) adjuvants.
	<i>trifloxystrobin</i> MOA 11 plus <i>fluopyram</i> MOA 7 Luna Sensation	4 to 6.7 fl ozs	+++++	12 hr/0 days	
	5.0-7.6 fl ozs	+++++	12 hr/1 day		
14 days pre-harvest (continued on next page)	<i>pyraclostrobin</i> MOA 11 plus <i>boscalid</i> MOA 7 Pristine 38W or	10.5-14.5 oz	+++++	12 hr/0 days	

PRE-HARVEST (continued)

Pre-harvest fungicide use-pattern for moderate to heavy brown rot pressure (normal to high moisture season with possible blossom blight and/or green fruit rot and possible fungicide resistance issues)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
14 days pre-harvest (continued)	<i>pyraclostrobin</i> MOA 11 plus <i>fluxapyroxad</i> MOA 7 Merivon	4 to 6.7 fl ozs	+++++	12 hr/0 days	
	<i>trifloxystrobin</i> MOA 11 plus <i>fluopyram</i> MOA 7 Luna Sensation	5.0-7.6 fl ozs	+++++	12 hr/1 day	
1-7 days pre-harvest	MOA 3 <i>Tebuconazole</i> Orius 20AQ	8.6-17.2 oz	+++++	12 hr/0 days	GA & SC have a 24C registration allowing application of Indar 2F at 12 ozs/acre.
	or <i>fenbuconazole</i> Indar 2F (GA & SC only-See Remarks)	6-12 fl oz	+++++	12 hr/0 days	
	or <i>mefentrifluconazole</i> Cevya	5 fl oz	+++++	12 hr/0 days	
OTHER PESTS:					
Rhizopus rot Botrytis rot	<i>dicloran</i> MOA 14 Botran 75W	1.33-5.33 lb	+++	12 hr/10 days	Rhizopus and botrytis rots are uncommon in Southeastern peaches. They are usually post-harvest problems and are associated with over-ripe fruit, though initial infections usually occur pre-harvest. Botran is not labeled for post-bloom use on plum. Even at maximum rates, Botran is not effective for brown rot control . In cool wet weather, Botran has some activity for botrytis.

PRE-HARVEST (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Anthracnose	<i>azoxystrobin</i> MOA 11 Abound 2.08F	12.3-15.4 fl oz	+++	4 hr/0 days	Anthracnose can infect fruit prior to harvest if conditions are wet and warm. Captan use during the cover sprays is recommended where anthracnose is a problem , and it is recommended that the MOA group 11 materials be utilized only for pre-harvest applications, since it is imperative that we maintain these for control of brown rot, and excessive use in earlier sprays will result in rapid resistance buildup. Captan close to harvest has been associated with some instances of fruit inking.
	<i>pyraclostrobin</i> MOA 11 plus <i>boscalid</i> MOA 7 Pristine 38 WG	10.5-14.5 ozs	++++	12 hr/0 days	
	<i>pyraclostrobin</i> MOA 11 plus <i>fluxapyroxad</i> MOA 7 Merivon	4.0-6.7 fl ozs	++++	12 hr/0 days	Anthracnose is caused by <i>Colletotrichum</i> fungus. A recent study showed that the <i>C. gloeosporioides</i> species complex is now most prevalent in SC and maybe elsewhere and that two subspecies were identified, <i>C. siamense</i> and <i>C. fructicola</i> . One of them (<i>C. siamense</i>) has developed resistance to FRAC 1 and 11 products. Therefore Merivon, Luna Sensation, Pristine and Quadris Top will not be effective against resistant <i>C. siamense</i> .
	<i>trifloxystrobin</i> MOA 11 plus <i>fluopyram</i> MOA 7 Luna Sensation	5.0-7.6 fl ozs	++++	12 hr/1 day	
	<i>difenoconazole</i> MOA 3 plus <i>azoxystrobin</i> MOA 11 Quadris Top	12.0-14.0 fl ozs	++++	12 hr/0 days	
	<i>difenoconazole</i> MOA 3 plus <i>cyprodinil</i> MOA 9 Inspire Super	16-20 fl oz		12 hr/2 days	
	plus <i>propiconazole</i> MOA 3 Tilt	4 fl oz	+++	12 hr/0 days	

PRE-HARVEST (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Assorted Insects 21 to 14-days pre-harvest	<i>phosmet</i> MOA 1B Imidan 70W (@ 14 or more days PH)	2.5-3 lb	++++	3 days/as-needed @ 14-days PHI	<p>A 14-day pre-harvest Imidan application is often satisfactory through harvest. If sap beetles have been a problem in the past and are abundant in the orchard floor, phosmet is the material of choice. However, if insects are present pre-harvest, they increase brown rot pressure, especially in wet weather. Imidan has, in a few instances, been associated with fruit inking.</p> <p>If not in fully enclosed protective cabs, mixers, loaders and airblast applicators must wear coveralls, chemical resistant gloves & footwear, and an approved respirator. Airblast applicators must also wear chemical resistant headgear.</p> <p>Tank mixes of Actara or Belay plus pyrethroids are the best options for stink bug control. Actara and Belay are both limited to 2 applications per season.</p> <p>Actara and Belay have very desirable worker safety profiles, accordingly, they are good choices during thinning.</p> <p>Actara, Belay and Imidan provide the longest residual activity.</p> <p>The diamides are most effective on Lepidopteran larvae, such as oriental fruit moth. There is some contact activity, with exposed insects becoming paralyzed and dying within 1-3 days. More effective when treated plant material is consumed.</p> <p>Avaunt is an effective, reduced risk, organophosphate replacement.</p> <p>Pyrethroids are not good stand-alone options for brown stink bug. Tank mixing with Actara or Belay improves stink bug control.</p>
	<i>Neonicotinoids</i> MOA 4A <i>thiamethoxam</i> Actara 25WP	4.5-5.5 oz	++++	12 hr/14 days	
	<i>clothianidin</i> Belay 2.1EC	6 fl oz	++++	12 hr/21 days	
	<i>Diamide</i> MOA 28 <i>chlorantraniliprole</i> Altacor 35WDG	3-4.5 oz	+++	4 hr/10 days	
	<i>cytraniliprole</i> Exirel	10-20.5 oz	+++	12 hr/3 days	
	<i>cyclaniliprole</i> Verdepryn 100SL	5.5-11 fl oz	+++	4 hr/7 days	
	<i>Na channel blocker</i> MOA 22A <i>indoxacarb</i> Avaunt	5-6 oz	++++	12 hr/14 days	
	<i>Pyrethroids</i> MOA 3A <i>esfenvalerate</i> Asana 0.66EC	2-5.8 fl oz	+++	12 hr/14 days	
	<i>beta cyfluthrin</i> Baythroid XL 1EC	2 fl oz	++++	12 hr/7 days	
	<i>zeta cypermethrin</i> Mustang Maxx	1.4-4.3 fl oz	++++	12 hr/14 days	
	<i>cyfluthrin</i> Tombstone 2EC	2 fl oz	+++	12 hr/7 days	

PRE-HARVEST (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Assorted Insects 7- to 3-day pre-harvest	<i>fenpropathrin</i> MOA 3A Danitol 2.4EC	11.2 fl oz	+++++	24 hr/as-needed @ 3-days PHI	Danitol provides very good control of plum curculio, stink bugs, caterpillar pests, sap beetles, June beetles and grasshoppers. Danitol is also a modestly effective, short-residual miticide. Note: wettable powder formulations typically offer some fruit finish advantages over emulsifiable concentrate formulations. Malathion is labeled for peach and nectarine, but some labels do not list plum. Avoid malathion use during slow drying conditions to minimize chances of phytotoxicity. Carbaryl has been associated with occasional inking of fruit.
	<i>beta cyfluthrin</i> MOA 3A Baythroid XL 1EC	2.8 fl oz	++++	12 hr/as-needed @ 7-days PHI	
	<i>cyfluthrin</i> MOA 3A Tombstone 2EC	2.8 fl oz	+++	12 hr/7 days	
	<i>malathion</i> MOA 1B Malathion 57EC	2 pt	+	24 hr/as-needed @ 7-days PHI	
	<i>carbaryl</i> MOA 1A Sevin XLR Plus Sevin SL	2-3 qt 2-3 qt	++ ++	12 hr/3 days 12 hr/3 days	
Stink bugs	<i>dinotefuron</i> MOA 4A Venom, Scorpion	3-4 oz	++++	12 hr/3 days	
As needed for Scarab beetles: Japanese beetles June beetles Rose chafer	<i>imidacloprid</i> MOA 4A Nuprid 4F Max	1.6-3.2 fl oz (foliar)	+++	12 hr/ 0 days (Nectarine & Peach) 12 hr/7 days (Cherry & Plum)	Imidacloprid provides good control of scarab beetles: June beetle, Japanese beetle and rose chafer, but imidacloprid does not control sap beetles or picnic beetles.

POST-HARVEST FRUIT HANDLING

HYDROCOOLING OR DIPPING—CHLORINATE AND BUFFER HYDROCOOLER OR DIP SOLUTIONS. MAINTAIN 25 TO 50 PPM FREE CHLORINE. MAINTAIN pH BETWEEN 6.5 AND 7.5. MONITOR SEVERAL TIMES A DAY. EMPTY, FLUSH AND RECHARGE HYDROCOOLERS DAILY. THE PRESENCE OF TRASH AND DISSOLVED ORGANIC MATTER HASTENS LOSS OF CHLORINE FROM SOLUTION. RUST FROM CORROSION OF STEEL SHOULD BE REMOVED BEFORE HARVEST BEGINS. DO NOT ADD FUNGICIDES TO THE HYDROCOOLER.

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Brown rot Rhizopus rot Gilbertella rot Sour rot Botrytis rot	<i>calcium hypochlorite</i> CCH HTH	N/A see remarks	+++++	N/A	Obtain agricultural use instructions from Olin Corporation, the dealer or county agent before using. Available as granular or tablets. Use 25 ppm. Typically, first dose is 4 lb/1000 gal of water. There are 7.48 gal per cubic ft of water. To avoid tank erosion and scaling, maintain water balance. Consult your county Extension agent.
	<i>sodium hypochlorite</i> AgClor 310		+++++	N/A	Available as 12.5% liquid. Product has limited shelf life. Do not save from season to season or check activity before using. May be used up to 100 ppm, but 50 ppm upper threshold is suggested to avoid discoloration. Typically, first dose is 0.75 gal/1000 gal of water. Use a buffer solution such as Decco 311 to adjust and prevent wide swings in pH. For In-Line Dip/Drench application of nectarines: Mix 16 fl oz of Chairman in 100 gallons of water, wax/emulsion, or aqueous dilution of wax/oil emulsion. Dip for approximately 30 seconds and allow fruit to drain.
	<i>fludioxonil</i> MOA 12 plus <i>Propiconazole</i> MOA 3 Chairman	16 fl oz/200,000 lb fruit	+++++	N/A	For In-Line Aqueous or fruit coating spray application: Mix 16 fl oz of Chairman in an appropriate water, wax/oil emulsion, or aqueous dilution of a wax/oil emulsion for the crop being treated. Use T-Jet, CDA, or similar application system. For maximum efficacy, use low volume concentrate application systems for treatment of plums.
Brown rot Rhizopus rot Gilbertella rot Botrytis rot	<i>fludioxonil</i> MOA 12 Scholar 50%	8-16 oz/ 200,000 lb fruit	+++++	N/A	Scholar is degraded by direct sunlight; treated fruit should not be stored in direct sunlight. Applications may be made using high-volume, low-volume or with dip applicator. Low volume applications are considered to be more effective. Scholar requires continuous agitation to prevent settling and poor performance. Use rates follow: High-volume (dilute) application: mix 8-16 oz Scholar in 25-100 gal of water or aqueous dilution of wax/oil emulsion. Apply to 200,000 lb of fruit. Low-volume (concentrate): mix 8-16 oz of Scholar in 7-25 gal of water or aqueous dilution of wax/oil emulsion. Apply to 200,000 lb of fruit. Use a control droplet-type application. Dip application: mix 8-16 oz of Scholar in 100 gal of water or aqueous dilution of wax/oil emulsion. Dip for approximately 30 seconds and allow fruit to drain. Dip solution should be replaced with fresh dip solution after 200,000 lb of fruit.
	Scholar SC	16 fl oz/200,000 lb fruit	+++++	N/A	

POST-HARVEST TREE PESTS

LESSER PEACHTREE BORER (LPTB) is a debilitating key pest in GA and SC. LPTB larvae attack the inner bark of all structural (weight-bearing) wood. Orchards heavily infested by LPTB suffer reduced fruit size and yield, with premature decline and death of fruiting wood scaffolds and, ultimately, tree death. LPTB controls are limited and preventative. At present no curative, clean-up treatments are available.

In middle GA, LPTB moths lay eggs from April well into November. LPTB larvae are particularly abundant in areas where bark has been injured or weakened by sunburn, cold injury to the undersides of scaffolds, scale, limb breaks, propping or tying, large, rough pruning cuts, disease cankers, and areas where existing LPTB wounds are present. LPTB moths do not glue their eggs in place. Smooth healthy bark, and well-healed smooth pruning cuts associated with thinning cuts (cutting at the origin of smaller limbs) are less prone to LPTB larval infestations.

POST-HARVEST TREE PESTS (continued)

LPTB control options are preventative. Curative application of *entomopathogenic nematodes* have shown promise on established LPTB and PTB infestations when used with an appropriate anti-desiccant to keep the borer wounds moist long enough for the nematodes to find larvae. Middle GA growers interested in on-farm trials should contact their county agent and fruit entomologist. It is quite important to protect trees from LPTB. **The most effective LPTB control programs rely on a combination of preventative insecticide sprays for LPTB applied pre-bloom, plus aggressive full-season cover spray programs. Pheromone mating disruption with LPTB pheromone has shown promise for LPTB and PTB. Use of mating disruption for borers is most appropriate in young orchards which have light to moderate borer pressure. Use of high-rate pyrethroid applications during periods of peak activity, typically into April - May in central GA and SC's Ridge, is an important component of LPTB management.**

PEACHTREE BORER (PTB) is a very important pest. Some reduction in control may be attributable to less effective cover spray options, but PTB control is generally good where a single yearly, post-harvest, handgun butt spray is made. PTB injury is very serious since its larvae infest the lower trunk and primary roots near the tree's crown. PTB's egg-laying period covers much of the summer and early fall. **Applying an insecticide on a block-to-block basis after harvest, but no earlier than 1 July, gives better control than waiting until August-September to spray everything at the same time. Every block should receive a single, handgun applied, barrier treatment with an insecticide every year.** Begin PTB sprays in an orchard's year of establishment. Sprays should pool up at the base of the tree. Application volumes of at least 1 quart of finished spray for mature trees, down to as little as 1 pint for 1st and 2nd leaf trees, are generally sufficient. **Airblast sprays are a very poor application technique for PTB sprays.**

BORER CONTROL IN TEXAS. Borers (LPTB and PTB) are common in some areas of TX, but uncommon in others. Where borers are present, control strategies and time of application are as listed. LPTB and PTB are common in the East Texas Timberlands and the Claypan areas and should be controlled with preventative post-harvest spray(s). LPTB and PTB are uncommon in the Edwards Plateau and the Cross Timbers areas of the Hill Country and North Central areas. If LPTB and/or PTB have not been detected in orchards in the Hill Country or North Central Texas, leave off borer sprays. However, monitor more closely for scale, as borer sprays suppress scale.

SCALE (primarily white peach scale & San Jose scale) are serious pests throughout the Southeast. Scale are very well camouflaged, infestations readily go unnoticed until after heavy, damaging infestations have developed. **Two dormant oil applications should be applied to every orchard annually.** Blocks receiving only one dormant oil application suffer a much higher incidence of scale outbreaks. Rates, or concentrations, of dormant oil are lower (1 to 1.5%), early in the dormant season and again as trees begin to break bud and lose dormancy. Rates for fully dormant trees should be in the 2 to 4% range.

SILVER MITES—Silver mites are common by early August. Peaches appear to tolerate silvering with minimal ill effects. Post-harvest miticide treatments are almost never appropriate.

EUROPEAN RED MITES (ERM) are occasional pests of peaches. ERMs are more important in the Southeast's cooler, more northerly production areas. ERMs overwinter on the trees, as contrasted to the twospotted spider mite which overwinters on the ground in the orchard floor cover. Dormant oil applications for scale provide excellent suppression of ERM.

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Lesser peachtree borer & Peachtree borer	<i>esfenvalerate</i> MOA 3 Asana XL	5.8 fl oz	+++	12 hr /14 days	Peachtree borer sprays are much more effective when applied as a directed, handgun application to the lower scaffolds, vase, and trunk post-harvest, but no earlier than 1 July. Altacor and Rimon have shown encouraging LPTB suppression in preliminary trials. Apply any of these 3 materials 1 to 2 times by airblast sprayer at 125 to 150 gal/A at 2-week intervals from April through May. Note the PHIs of each material.
	<i>chlorantraniliprole</i> MOA 28 Altacor 35WDG	4.5 oz	+++	4 hr/10 days	
	<i>novaluron</i> MOA 15 Rimon 0.83EC	20 fl oz	+++	12 hr/8 days	Rimon applications may help suppress picnic and sap beetles.
	<i>acetamiprid</i> MOA 4 Assail 30SG	5.3-8 oz	+++	12 hr/7 days	
(continued on next page)					

POST-HARVEST TREE PESTS (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Lesser peachtree borer & Peachtree borer (continued)	<i>acetamiprid</i> + <i>novaluron</i> MOA 4 + 15 Cormoran	20 fl oz	++++	12 hr /8 days	
	<i>Beneficial Entomopathogenic Nematodes, Steinernema carpocapsae</i> BioSc Nemasys C	500,000 to 1 million nematodes per tree	++++	0 hr / 0 days	Apply to the base of each tree. Irrigation is recommended to keep soil moist during application and at least 10 days after. Remove fine screens and filters (50-mesh or less) from sprayer to avoid shredding the nematodes. Applications should be made in September and a follow-up application can be made in the early spring when soil temperatures reach 70°F. If irrigation is lacking, then Barricade® gel at 1-2% can be mixed with nematode suspensions to help maintain soil moisture.
Scale (alone)	<i>diazinon</i> MOA 1B Diazinon AG-500	1 pt	+++	96 hr/21 days, recommended post-harvest only	Diazinon is not recommended for use in-season. Diazinon use has been associated with fruit finish problems in several crops. However, diazinon provides very good control of scale. Apply diazinon as a dilute spray. Check infested limbs for crawler emergence before applying.
	<i>summer oil</i> TriTek	1 to 1.5% by volume, 1-2 gal/100 gal spray	++	4 hr/ recommended post-harvest only	Apply dilute, at least 125 gal per acre. Do not apply when fruit is present or daytime temperatures reach the high 90's. Do not apply within 2 weeks of applying sulfur, captan or Sevin.
	<i>superior oil</i>	apply 125 to 150 gal final mix/acre	+++++ when 2 sprays are applied	12 hr/ not recommended until after leaf fall	Adjust oil rate downward when spraying during early- or two late-dormancy. In GA and SC, all blocks, bearing and non-bearing, should receive dormant oil application.
	partially dormant trees	5 to 7.5 gal oil/ 500 gal tank/ 4 acres (1-1.5%)	+++ when 1 spray is applied		Partially dormant is defined as after 95% leaf drop and some early winter cold.
	dormant trees	10 to 20 gal oil/ 500 gal tank/ 4 acres (2-4%)			
<i>spirotetramat</i> MOA 23 Movento 2EC	6-9 fl oz	6-9 fl oz	++++	24 hr/7 days	Movento controls multiple scale life stages. Movento use post-harvest is inconsistent. If warm temperatures and flushing new growth is present Movento can <i>sometimes</i> be effectively post-harvest.

POST-HARVEST TREE PESTS (continued)

Pest(s)	Material(s)	Formulated Product/Acre	Effectiveness	REI/PHI	Remarks
Weeds	<i>Indaziflam</i> Alion	3.5 fl.oz/A	+++++	12 hr/14 days	A PRE herbicide application to the weed-free strip between mid October thru November will provide residual weed control into early May. The addition of a non-selective POST herbicide (ie. paraquat or glufosinate) will be necessary to control emerged weeds.
	<i>penoxsulam plus oxyfluorfen</i> Pindar GT	2 to 3 pt/A	+++++	24 hr/60 days	
	<i>flumioxazin</i> Chateau EZ or a generic alternative	6 to 8 oz/A	+++++	12 hr/60 days	



POISON CONTROL CENTERS AND EMERGENCY FACILITIES

Nationwide Poison Control Helpline 1-800-222-1222

**This number goes to an automated system that routes calls
to the nearest Poison Control Center by area code.**

<http://www.aapcc.org/>

Seasonal “at a glance” disease control schedule options for stone fruit^a

Developmental Stage	Dormant	Delayed Dormant (1-5% bud swell)	Pink to 5% Bloom	Bloom	Petal Fall to 1% Shuck Split	Shuck Split to 10% Shuck Off Cover Spray	7-10 Days After Shuck Split Cover Spray	Summer Cover Sprays (multiple sprays)	Pre-Harvest (21 days prior to harvest)	Pre-Harvest (14 days prior to harvest)	Pre-Harvest (7 days prior to harvest)	At- or In-Harvest (1 day before or during harvest)	Post-Harvest
Disease Controlled (Fungicides or Bactericides/Antibiotics)	Bacterial Spot and Leaf Curl (Coppers)	Bacterial Spot and Leaf Curl (Coppers)	Bacterial Spot and Leaf Curl (Coppers)	Blossom Blight (Captan or Bravo or Topsin M ^c + Captan or Rovral or Vanguard or Scala)	Scab and Brown Rot (Bravo or Captan or Abound or Gem or Miravis) ^f	Scab and Brown Rot (Bravo or Captan or Abound or Gem or Miravis) ^f	Scab (Sulfur or Captan) ^e	Scab (Sulfur or Captan) ^e	Brown Rot (Captan or Captan + Topsin M ^c or Captan + Abound or Captan + Miravis or Captan + Fontelis) ^g	Brown Rot (Pristine or Merivon or Luna Sensation)	Brown Rot (Bumper or PropiMax or Orius or PropiMax or Orius or Indar or Cevya or Pristine or Merivon)	Brown Rot (Bumper or PropiMax or Orius or Indar or Cevya or Pristine or Merivon)	Brown Rot, Gray Mold, Rhizopus Rot, and Gilbertella Rot (Scholar)
	Leaf Curl [<i>only</i>] (Ferbam) ^b		Black Knot [<i>plum only</i>] (Bravo or Topsin M ^c + Captan)	Black Knot [<i>plum only</i>] (Bravo or Topsin M ^c + Captan)	Bacterial Spot (Coppers or Mycoshield or Fireline)	Bacterial Spot (Coppers or Mycoshield or Fireline)	Green Fruit Rot and/or Anthracnose (Captan)	Green Fruit Rot and/or Anthracnose (Captan)				*Inspire Super and Luna Sensation can be utilized, but note that they have a 2 and 1 day PHI, respectively, as opposed to 0 day PHI with the materials above.	Brown Rot, Gray Mold, Rhizopus Rot, and Gilbertella Rot, Sour Rot (Chairman)

^aFungicides, bactericides and antibiotics are listed throughout this “at a glance” guide for each phenology (growth stage) in which we recommend that they could be utilized for maximum efficacy and resistance management. This does not necessarily imply that a single fungicide can be utilized at all the growth stages in which they are listed. For example, on peach, Topsin M + Captan is listed for potential application at bloom or 21 days prior to harvest, but we would only recommend one application per season. Likewise, Miravis is recommended if needed for extra scab control at petal fall and shuck split, but we recommend that one only use Miravis as a solo application once per season. As always, follow all label directions as to the number of applications allowed per season, maximum amounts of active ingredient allowed per year, reentry and pre-harvest intervals.

^bFerbam is the material of choice for leaf curl. Chlorothalonil (various formulations), Ziram and Thiram have leaf curl activity, but they are less effective than Ferbam. Where leaf curl is severe, make 2 applications, one early winter after leaf fall and the other prior to bud swell. Orchards receiving Captan cover sprays the previous growing season are less affected by leaf curl.

^cFungi readily develop resistance to Topsin M. Never use Topsin M more than once per season. Always tank mix Topsin M with Captan for resistance management and to ensure efficacy if resistance has developed.

^dPowdery mildew is more prevalent on some varieties than others, and it is more problematic in dry springs. Powdery mildew active materials should be considered for early sprays in particularly susceptible varieties.

^eWhen rainfall is prevalent, use Captan products instead of sulfur during cover sprays. Research has shown that Captan is more efficacious than sulfur for both scab and brown rot control, but it is weak against powdery mildew. Sulfur will only control scab and powdery mildew.

^fPetal fall and shuck split are critical times for scab management. When managing scab and brown rot at petal fall and shuck split, Bravo (and generics) and Captan products should generally be utilized. Use Abound, Gem, or Miravis if scab pressure is expected to be uncommonly high. However, Abound, Gem, and Miravis are all single-site mode-of-action products, and they are prone to resistance development; only use these during this timeframe if necessary. It is preferred that we use these classes of chemistry as little as possible and that we reserve these for pre-harvest sprays. This is especially true of Miravis, and it should only be utilized once per season without tank-mixing with another fungicide.

^gIf conditions are dry prior to harvest, Captan alone may be sufficient at the 21-day before harvest spray. If conditions are wet, more efficacious fungicides are recommended. Miravis, Fontelis, and Abound are all single-site mode-of-action products. Resistance development is possible for Miravis and Fontelis (both SDHIs), and though less likely for Abound (QoI), all three will benefit through tank-mixing with Captan as a resistance management tool. Use of Captan too close to harvest has been associated with inking and discoloration of fruit, so this would be the last time to use Captan in a spray program.

^hAlternation of oxytetracycline and low rates of copper products can be utilized for resistance management and to reduce damage from copper.

EFFECTIVENESS OF DISEASE CONTROL MATERIALS ON PEACHES, NECTARINES AND PLUMS IN THE SOUTHEAST

(+++++ = superior; +++++ = excellent, ++++ = good, +++ = fair, ++ = poor, + = suppression, - = no benefit)

See IPM Management Guide section for rate/disease particulars. These ratings are benchmarks, actual performance will vary.

Pesticide [MOA CODE]	Class	Leaf curl	Bacterial spot	Blossom blight	Scab	Anthracnose	Red spot	Sooty peach	Brown rot	Rhizopus rot
Abound [11] Gem [11]	QoI (quinone outside inhibitor)	-	-	-	++++ Resistance a threat	++++	-	-	++++ Resistance a threat	-
coppers [M1]	multi-site toxins	+++	+++ Resistance a threat	-	-	-	-	-	-	-
Botran [14]	multi-site toxin	-	-	+	-	-	-	-	+	++
Mycoshield [41] FireLine [41]	antibiotic	-	+++ Resistance a threat	-	-	-	-	-	-	-
captan [M4]	multi-site toxin	-	-	++	++++	+++	-	++	+++	+
Ferbam [M3]	multi-site toxin	+++++	-	-	-	-	+++	-	-	-
Thiram [M3]	multi-site toxin	+++	-	-	-	-	+++	-	-	-
ziram [M3]	multi-site toxin	+++	+	-	+	-	+++	+++	-	-
sulfur [M2]	multi-site toxin	-	-	+	+++	-	-	-	+	-
chlorothalonil [M5]	multi-site toxin	+++++	-	+++	++++	-	-	-	-	-
Rovral [2]	dicarboximide	-	-	++++	-	-	++	++	-	-
Orius [3]	DMI (dimethylation inhibitor)	-	-	+++++	-	-	-	-	+++++ Resistance a threat	-
Quash [3]	DMI	-	-	+++++	-	-	-	-	+++++ Resistance a threat	-
Indar [3]	DMI	-	-	+++++	++	-	-	-	+++++ Resistance a threat	-
Cevya [3]	DMI	-	-	+++++	++	-	-	-	+++++ Resistance a threat	-
Rally [3]	DMI	-	-	+++	-	-	-	-	+ Resistance a threat	-
Orbit [3] PropiMax [3] Bumper [3]	DMI	-	-	++++	-	-	-	-	++++ Resistance a threat	-
Topguard [3]	DMI	-	-	++++	-	-	-	-	++++ Resistance a threat	-

EFFECTIVENESS OF DISEASE CONTROL MATERIALS ON PEACHES, NECTARINES AND PLUMS IN THE SOUTHEAST (continued)

Pesticide [MOA CODE]	Class	Leaf curl	Bacterial spot	Blossom blight	Scab	Anthracnose	Red spot	Sooty peach	Brown rot	Rhizopus rot
Topsin-M [1] Thiophanate Methyl [1]	MBC (methyl benzimidazole carbamate)	-	-	++++ Resistance a threat	++++ Resistance a threat	-	-	-	+++ Resistance a threat	-
Vanguard, Scala [9]	anilinopyrimidine	-	-	++++	-	-	-	-	-	-
Inspire Super [9, 3]	anilinopyrimidine and DMI	-	-	+++++	+++	?	-	-	+++++	?
Inspire Super [9, 3] plus Tilt [3]	Anilinopyrimidine and DMIs	-	-	+++++	+++	++++	-	-	+++++	?
Scholar [12]	phenylpyrrole	-	-	-	-	-	-	-	+++++	++++
Fontelis [7]	SDHI-pyrazole carboxamide	-	-	++++	++	+	-	-	++++ Resistance a threat	+
Merivon [11, 7]	QoI and SDHI-pyrazole	-	-	+++++	++++	++++	-	-	+++++	+++
Luna Sensation [11, 7]	QoI and SDHI - pyridinyl-ethyl-benzamides	-	-	+++++	++++	++++	-	-	+++++	+++
Pristine [11, 7]	QoI and SDHI-pyridine-carboxamide	-	-	+++++	++++	++++	-	-	+++++	+++
Quadris Top [11, 3]	QoI and DMI	-	-	++++	++++	+++	-	-	++++	++

Fungicides with the same MOA CODE, unless multi-site, are NOT appropriate as tank-mixing partners or for alternating as they have similar modes of action and are prone to cross-resistance.

PEACH INSECTICIDE AND MITICIDE CLASSES AND EFFICACY RATINGS

(+++++ = excellent, ++++ = good, +++ = fair, ++ = poor, + = suppression, - = no or unknon benefit)

See IPM Management Guide section for rates and particulars. These ratings are benchmarks, actual performance will vary.

<i>Pesticide (MOA code)</i>	<i>Trade Name(s)</i>	<i>Scale</i>	<i>Thrips</i>	<i>Oriental fruit moth</i>	<i>Plum curculio</i>	<i>Plant or Stink bugs</i>	<i>June beetles, etc.</i>	<i>Mites</i>	<i>Borers</i>
<i>abamectin (6)</i>	Agri-Mek	-	++	-	-	-	-	++++	-
<i>acetamiprid (4A)</i>	Assail 30SG	+++	++	++++	++	++	+++++	-	+++
<i>beta cyfluthrin (3A)</i>	Baythroid XL	-	+	+++++	++++	+++	++++	-	++
<i>bifenazate (UN)</i>	Acramite	-	-	-	-	-	-	+++++	-
<i>buprofezin (16)</i>	Centaur	+++++	-	-	-	-	-	-	-
<i>Burkholderia A396 (UN)</i>	Venerate XC	++	-	-	-	+++	-	-	-
<i>carbaryl (1A)</i>	Sevin	-	-	+++	++	++	+++++	-	+++
<i>chlorantraniliprole (28)</i>	Altacor	-	-	+++++	++	-	-	-	+++
<i>Chromobacterium subtsugae PRAA4-1 (UN)</i>	Grandevo WDG	++	-	-	-	-	-	-	-
<i>clofentezine (10A)</i>	Apollo	-	-	-	-	-	-	++++	-
<i>clothianidin (4A)</i>	Belay	-	+	++	++++	+++	++++	-	++
<i>cyclaniliprole (28)</i>	Verdepryn	-	-	++++	++	-	-	-	-
<i>cyantraniliprole (28)</i>	Exirel	-	-	++++	+++	-	-	-	-
<i>cyfluthrin (3A)</i>	Tombstone	-	+	+++++	+++	+++	++++	-	++
<i>cyfluthrin (3) + imidacloprid (4A)</i>	Leverage	-	+	++++	+++	+++	++++	-	++
<i>cyhexatin (12B)</i>	Vendex	-	-	-	-	-	-	+++	-
<i>diazinon (1B)</i>	Diazinon	+++	+	++++	++	++	++++	-	+
<i>dinotefuron (4A)</i>	Venom/Scorpion	-	-	-	-	++++	-	-	+
<i>esfenvalerate (3A)</i>	Asana	-	+	+++++	+++ - ++++	++	++++	-	++
<i>etoxazole (10B)</i>	Zeal	-	-	-	-	-	-	++++	-
<i>fenpropathrin (3A)</i>	Danitol	-	++	+++++	++++	++++	++++	++	++

PEACH INSECTICIDE AND MITICIDE CLASSES AND EFFICACY RATINGS (continued)

<i>Common Name (MOA #)</i>	<i>Trade Name(s)</i>	<i>Scale</i>	<i>Thrips</i>	<i>Oriental fruit moth</i>	<i>Plum curculio</i>	<i>Plant or Stink bugs</i>	<i>June beetles, etc.</i>	<i>Mites</i>	<i>Borers</i>
<i>hexythiazox (10A)</i>	Savey	-	-	-	-	-	-	++++	-
<i>horticultural oils</i>	miscellaneous	+++ - +++++	-	-	-	-	-	++	-
<i>imidacloprid (4A)</i>	Nuprid 4F Max	-	-	-	-	-	+++	-	-
<i>indoxacarb (22A)</i>	Avaunt	-	-	++++	++++	-	-	-	+
<i>Isomate (mating disruption)</i>	Isomate-PTB Dual Isomate-LPTB Plus	-	-	-	-	-	-	-	+++ to +++++
<i>lambda cyhalothrin (3A)</i>	Lambda-T Silencer Warrior II	-	+	+++++	++++	++	++++	-	+
<i>lambda-cyhalothrin + thiamethoxam (3A + 4A)</i>	Endigo ZC	-	+	++++	++++	+++	++++	-	-
<i>malathion (1B)</i>	Malathion	+	+	++	++	+	+	+	+
<i>methomyl (1A)</i>	Lannate	-	++	++	+	++	++	-	-
<i>novaluron (15)</i>	Rimon	-	+	++++	+	+	-	-	+
<i>permethrin (3A)</i>	Ambush Pounce	-	+	+++++	++	++	++++	-	+
<i>phosmet (1B)</i>	Imidan	-	-	+++++	+++++	+++	++++	-	+
<i>pyridaben (21A)</i>	Nexter	-	-	-	-	-	-	++++	-
<i>pyriproxyfen (7C)</i>	Esteem	+++++	-	++	-	-	-	-	-
<i>spinetoram (5)</i>	Delegate	-	+++	++++	-	-	-	-	+
<i>spinosad (5)</i>	SpinTor Entrust	-	++	++	-	-	-	-	-
<i>spirodiclofen (23)</i>	Envidor	-	-	-	-	-	-	-	-
<i>spirotetramat (23)</i>	Movento	+++++	-	-	-	-	-	-	-
<i>thiamethoxam (4A)</i>	Actara	-	+	++	++++	+++	++++	-	-
<i>zeta cypermethrin (3A)</i>	Mustang Maxx	-	+	+++++	++++	++	++++	-	++

WEED RESPONSE TO HERBICIDES

Application Method ¹	diuron		Flumioxazin		Solicam		Sinbar		Alion		pendimethalin		simazine		oxyfluorfen		rim-sulfuron		Fusilade, Select+		glyphosate		paraquat		2,4-D		clopyralid ⁴		Poast		Pindar GT		Glufosinate	
	PRE		PRE		PRE		PRE		PRE		PRE		PRE		PRE		PRE/PDS		PDS		PDS		PDS		PDS		PDS		PDS		PDS		PDS	
Time of Year ²	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	S	S	F	S	F	S	F	S	F	S	F	S	F	S	F			S	F
BIENNIAL AND PERENNIAL WEEDS																																		
asters	F	G					F	G	P	P	P	P		G	F	F			P	P	G	E	F	F	F				P	P			G	
bahiagrass	P	P	P	P	P		P-F	P-F	P	P	P	P	P	P	P	P			F	P	F	F	F	F	P	P			F	P			P	
bermudagrass	P	P	P	P	F	F	F	P	P	P	F	F	P	P	P	P			G	F	F	G	F	P	P	P			G	P-F			F	
briars	P	P	P	P	P	F	P	P	P	P	P	P	P	P	P	P			P	P	P-F	G-E	P	P	F	F			P	P			F	
camphorweed						G	F		P	P	P	P		G		G			P	P	G		F						P	P				
dallisgrass	P	P	P	P	F		P-F	P-F	P	P	P	P	P	P	P	P			F	F	G	G	F	P	P	P			P	P			F	
dogfennel	P	F	P	P		E	G	G	P	P	P	P	P	F					P	P	G	G	F	P			F		P	P				
horsenettle	P-F	P	F	P	P	P	F	P	P	P	P	P	P-F	P	P	P			P	P	F	G	P	P	F				P	P			F	
johnsongrass	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P			G	P	F	G	F	P	P	P			G	F				
nutsedge	P	P	P	P	P-F		P-F	P-F	F	P	P	P	P	P	F	F	F		P	P	F	G	F	F	P				P	P				
plantains			G	G		G		F		P	P	P	P	G					P	P	E	E	F	F	G	G			P	P			G	
wild garlic/onion	P	P	P			G			P	P	P	P	P	P					P	P	G	G	F	F	G	G			P	P				
ANNUAL GRASSES																																		
barnyardgrass	G		G		G		G		G		G		G		F		G		G		E		G		P	P			G				G	
crabgrass	G		E		G-E		G		E		E		G		F		G		G		E		G		P	P			G				G	
crowfootgrass	G				G		G		E		E		G		F				G		E		G		P	P			G				G	
fall panicum	F		G		E		G		G		G		G				F		G		E		G		P	P			G				G	
goosegrass	G		E		E		G		E		E		G		F				G		E		G		P	P			G				G	
Johnsongrass (seedling)	F		G		G		G		G		G		P						E		E		E		P	P			E					
ryegrass, annual		G		F				F		G		F-G		G-E	P				G	G	G	G	F	G	P	P			E	E			G	
sandbur	G				G		G		G		E		G		P				G		E		G		P	P			G				G	
signalgrass, broadleaf	G		G		G		G		E		G		P		P				E		E		G		P	P			E					
Texas panicum	P		G		F		F		G		G		F		P				E		E		E		P	P			E				G	

WEED RESPONSE TO HERBICIDES (continued)

	diuron		Flumioxazin		Solicam		Sinbar		Alion		pendimethalin		simazine		oxyflurofen		rim-sulfuron		Fusilade, Clethodim ⁺		glyphosate		paraquat		2,4-D		clopyralid ⁴		Poast		Pindar GT		Glufosinate	
Application Method ¹	PRE		PRE		PRE		PRE		PRE		PRE		PRE		PRE		PRE		PDS		PDS		PDS		PDS		PDS		PDS		PDS		PDS	
Time of Year ²	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	S	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F
ANNUAL BROADLEAF WEEDS																																		
bristly starbur	G		G		F		E				P		F		F-G				F	P	G		F-G		G				P					
chickweed	G	G		E	E	E		E		E		G		G			G	P	P	G	G	F	G	F	F	F			P	P	E	E	G	G
cocklebur	G		F		F		G		F		P		F		G		F		P	P	E		G		E	E	E		P				G	
crotalaria	G		P				G				P				E				P	P	E		G		G		G		P					
croton, tropic	G		E		E		G		G		P		F-G		E				P	P	E		F-G		G				P				G	
evening primrose		G	G	E			F	G		G	P		G-E	F	G				P	P	P-F	F	F	F-G	F	G			P	P	G	E	G	G
Florida beggarweed	G		G		G		E				P		G		P				P		E		E		F				P				G	
Florida pusley	G		E		G		E				G		G		E				P		G		F ³		F				P				G	
horseweed	F	G	G	G	G	G	G	G	G	G	P	P	P	G	P	F			P	P	G-E	G-E	F*	F	G		E	E	P	P	G	E	E	E
jimsonweed	G		G		G		E		G		F		F-G		G				P		E		G		E		E		P		G		G	
lambsquarters	E		E		F		E		E		E		E		E				P		G		G		E				P		E		G	
morningglories	G		G-E		F-G		G-E		G		F		F-G		F-G		G		P		G		G		G				P		F		G	
pigweeds	G		E		F		E		E		G		F-G		E		E		P		G		G		G				P		G		G	
prickly lettuce		G			G			E		G	P	P	G	E		G			P	P	G	G	F	G	G	G	G	G	P	P	G	G		G
prickly sida (teaweed)	G		G		G-E		E		G		P		F-G		E				P		G	F	G	P	G				P		F		E	
purslane, common	E		E		E		E				E		E		E		E		P		E		G		E				P		E		G	
ragweed, common	E		E		G		E		G		P		G		E		F		P		G		G		E	E	G		P				G	
sicklepod	G				F		E				P-F		F-G		F		G		P		G		E		E		E		P				E	
wild radish	F-G	G	E	E	F	G	E	E		G	P	P	G	E	G-E	E		G	P	P	E	E	F	G	G	G			P	P	G	E	G	

¹ PRE = Pre-emergence; PDS = Post-emergence Directed Spray.
² S = Spring; F = Fall.
³ Paraquat will control only the seedling stages of Florida pusley.
⁴ Clopyralid is very effective on the following species not included in the chart; all clover, vetch, thistle, nightshade species, and curly dock.
* Paraquat provides only contact control of many species.
⁺ Fusilade and Select are fluazifop and clethodim, respectively; and have similar activity on most weeds.

Key to Response Symbols: E = Excellent Control; G = Good Control; F = Fair Control; P = Poor Control.
If no symbol is given, weed does not occur in specific season (spring or fall) or weed response is unknown.

PESTICIDE SAFETY

PESTICIDE POISONING — Symptoms of pesticide poisoning may include headache, pin-point pupils, blurred vision, weakness, nausea, cramps, diarrhea, and chest discomfort. If symptoms occur within 24 hours after mixing, loading, applying, or following any accidental exposure, stop work at once and take care of individuals who may have been poisoned. When exposures occur, the basic rule to remember is “Dilute the pesticide.” If pesticide is spilled on the skin, immediately remove contaminated clothing, and wash the area gently but thoroughly with large amounts of soap and clean lukewarm water. If pesticide gets in someone’s eye(s), immediately remove any contact lenses, and destroy them, then flush the eye for 15 minutes with a gentle stream of clean water or eyewash solution. This requires approximately 6 gallons of clean water or eyewash solution. If pesticide is inhaled, move the individual to open, clean air and have the person lie down. If pesticide is ingested, rinse out the mouth and follow the pesticide label directions for first aid. Be familiar with the label first aid statements prior to finding someone in trouble. **If the situation indicates, give CPR and immediately contact your physician, local emergency room, or poison control center (1-800-222-1222). Transport the victim to the nearest medical care facility. Take the pesticide label and the chemical’s Safety Data Sheet (SDS) with you or have others get it to the facility at the same time as the victim. Do not transport the pesticide container in the vehicle with the victim** or allow other people or objects to become contaminated by the pesticide.

Failure to follow pesticide label precautions can lead to lethal consequences for pesticide handlers, especially from overexposure to organophosphate or carbamate insecticides/nematicides which affect the nervous system. **Follow all label safety precautions. Some pesticides do not have any antidote or effective treatment** once sufficient exposure has occurred! Those safety precautions and personal protective equipment are not only legal requirements but are there to protect you and your employees! Be especially aware of safety during mixing, loading, and application where acute pesticide exposure is most likely to occur. More than 90% of occupational exposure is through the hands and forearms. That is why you must always wear a long sleeve shirt and use chemical resistant gloves. Most oral exposure also comes about from hands or forearms contacting the mouth or skin around it. Use chemical resistant gloves (nitrile, butyl rubber, etc.) and replace them regularly or whenever they leak or become damaged. Rubber boots prevent acute exposure from spills and chronic exposure from accumulation of residues in materials of boots and shoes. Pantlegs should be on the outside of boots or shoes and not tucked into boot or sock. **The Personal Protective Equipment (PPE) on the pesticide label is not a suggestion—it is the legally required minimum protection for pesticide use and a different level of protection may be required for mixers and loaders, for applicators, and/or for early entry workers.**

PESTICIDE SIGNAL WORDS — In order from most dangerous to least: **Danger Poison** accompanied by skull and crossbones means *a few drops to a teaspoon can kill*; **Danger** indicates **eye and skin damage concerns are greater than acute lethal toxicity** (even though these materials can kill at small doses); **Warning** indicates moderate toxicity **where one to two tablespoons can kill** and **eye and skin damage** is of moderate concern; **Caution** indicates slight toxicity where it takes a pint or more to kill and eye and skin effects are mild or slight. Pay particular attention to labels of pesticides displaying a Warning signal word for they often are of serious concern from multiple routes of entry.

PERSONAL PROTECTIVE EQUIPMENT — Minimum personal protective equipment (PPE) **must be used** as noted on the label. Using additional PPE beyond the minimum requirements is always encouraged; remember it’s your personal health and safety. There may be different minimum PPE requirements for loading, mixing, or applying and is subject to change during product reregistration. Applicators must read each product’s label and maintain a wardrobe of protective equipment for applicators and pesticide mixers/handlers.. Even if you have read the label before, always refresh your memory by reading the label again before each use. Labels constantly change as new information is discovered or required and uses are restricted or expanded.

CLASSIFICATION OF PESTICIDES — Pesticides that the U.S. Environmental Protection Agency (EPA) determines need additional regulatory restrictions to avoid unreasonable adverse effects on humans (mixers, handlers, others), other organisms, or the environment are classified as **Restricted Use**. Restricted Use pesticides may only be purchased and applied by certified licensed applicators or individuals under their direct supervision. Lower risk pesticides are classified as “General Use” or remain “Unclassified.” General Use and Unclassified pesticides may be purchased by the public without a license so long as they are to be used on the individual’s own property or their rented property. All pesticides must be strictly applied according to their label directions.

RECORD KEEPING — **In Georgia, licensed pesticide contractors must keep a record of all pesticide applications that are made as a part of their business.** If an individual has a Commercial Pesticide Applicator license and charges a fee for any application, they must have a pesticide contractor’s license for each business location and at least one full-time licensed commercial applicator employed at that location. Any licensed Commercial Pesticide Applicator who is not operating under a Pesticide Contractor’s License must keep a record of all restricted-use pesticide applications. Licensed Private Applicators are required to keep records of their use of restricted-use pesticides unless they fall under EPA’s Worker Protection Standard regulations, in which case all applications must be recorded. Georgia requires all records of pesticide application include the date and time of application; the name of person for whom it was applied; the location of the application site; the crop or target to which it was applied; the acreage, size of area treated, or total amount of pesticide applied; the target pest; the pesticide used and the application rate; the type of equipment used; the name of the applicator; a notation of any unexpected occurrence at or during application, such as spillage, exposure of humans or non-target animals, or drift, and any corrective or emergency action taken; and the names, concentrations and quantities of all pesticides disposed of and the manner of their disposition. Applicators can make their own record keeping form so long as it contains all of the information mentioned above, use the USDA Agriculture Marketing Services (AMS) record keeping form or purchase the Georgia Recordkeeping Manual: for Private or Commercial Pesticide Applicators that was designed specifically to comply with pesticide application recordkeeping in Georgia. The AMS record keeping form (both English and Spanish versions are available) can be downloaded from their website: <https://www.ams.usda.gov/rules-regulations/pesticide-records>. The Georgia specific record keeping manual (English version only) can be purchased from the UGA Extension Publications Store: <https://tinyurl.com/53rvrv5w>.

LICENSING OF APPLICATORS — The Georgia Department of Agriculture has specific pesticide licensing and recertification requirements. Restricted Use products may only be purchased and applied by licensed certified applicators or persons under their direct supervision. Commercial applicators are required to pass a test covering general standards for pesticide applicators and one or more speciality category tests to become a licensed certified applicator. The license is valid for five years and requires the applicator to complete specific numbers of continuing education credits/hours at least 90 days prior to the license expiration date. Private applicators must complete a training program (your county agent can provide you with instructions on how to access the training course) and certify to their local county agent that they are engaged in the production of an agricultural or forestry commodity. Private pesticide licenses are valid for a 5-year period and require three credit hours of continuing education at least 90 days prior to the license expiration date. Check with your county agent for licensing, document requirements, and continuing education programs.

ENDANGERED SPECIES ACT (ESA) — The ESA is enforced by the EPA. This act prohibits the use of certain pesticides in designated locations where their use may pose risks to endangered species. ESA sections on pesticide labels restrict use in specific counties or areas within counties. Users of pesticides with ESA sections for their counties/areas must obtain an EPA-use bulletin for the specific pesticide for protection of endangered species. The bulletins are available from a variety of sources, including the EPA Bulletins Live! Two, pesticide dealers, USDA-NRCS (Natural Resources Conservation Service) and county Extension offices. It is up to the individual pesticide applicator to secure, even if not easily found, and follow the directions in these bulletins.

WORKER PROTECTION STANDARD (WPS) — The 2015 WPS applies to agricultural workers performing a variety of tasks. The WPS specifically covers agricultural workers, mixers, loaders, applicators, and those who repair application equipment. WPS mandates specific restricted entry intervals, personal protective equipment, emergency assistance, employee pesticide safety education, and worker access to displayed information. A specific product's WPS mandates will be found in the **Agricultural Use** section of a product's **Directions for Use**. The WPS requires employers to train all workers prior to their working in an area where a pesticide has been used or a restricted-entry interval has been in effect in the past 30 days. They must display application information and safety data sheets (SDSs) at a central location within 24 hours of the end of the application and before workers enter that treated area. Both must be displayed for 30 days following REI expiration and the application information and SDSs must be kept for 2 years from the end of the REI and made available to workers, handlers, their designated representatives, or treating medical personnel upon request. A "How to Comply" manual is available from the UGA Extension Publications Store: <https://tinyurl.com/53rvrv5w>.

PESTICIDE FIRE PLAN — Plan for a fire emergency: 1) provide clear plan-of-action instructions to guide responses during the critical, confusing early minutes of a fire; 2) provide fire officials with a summary of the chemicals stored and information on hazards and special fire-fighting techniques; and 3) demonstrate evidence of prior planning to reduce fire-related risks, should charges of negligence or lawsuits follow. **Fire and Emergency Response.** Individual farms should contact their local First Responder units prior to needing them for an emergency event. At a minimum, growers and farm operators should provide First Responders with an inventory of the pesticides and other agrichemicals that may normally be expected to be in storage at each location during the season or year, and a **map of the farm with clear designation of pesticide and fertilizer storage facilities, and any compressed gas sites**. It is important that your local fire department(s) understand that it is **inappropriate to apply water, or at least heavy hose streams, to fires in pesticide and/or fertilizer storage facilities**. Farm maps should also include the locations of cut-offs for electricity, gas and fuels, and the location of water sources. Water sources may need to be protected by diking or other means. Runoff of chemicals and water from spills or fires must be contained. In the event of a fire or other emergency, every employee and family member on the farm should be capable of contacting First Responders. For additional information on pre-planning with your local First Responders, contact University of Georgia's Pesticide Safety Program Coordinator at (706) 542-2141 or email to ajohns14@uga.edu.

PESTICIDE STORAGE — Safe pesticide storage significantly increases farm safety and protects your pesticides. Inadequate storage exposes your farm to the costs and difficulty of clean-up; liability in the event of a spill or fire; liability if a person or animal is injured or killed; the costs of EPA/state/OSHA fines; your cost and time to correct violations; and finally, the cost of the pesticides. UGA Extension Bulletin 1095: Pesticide Storage and Mixing Facilities can provide thoughtful guidance in preparing a pesticide storage site. Visit the University of Georgia Extension Publication website for access: <https://extension.uga.edu/publications.html>.

PEACH PEST MANAGEMENT STRATEGIES

Peach pest management strategies are a key to successful orchard management. Pest management in long-term perennial systems is complicated by insect and disease carry-over from one season to the next. **Cultural and pest management practices** are very interactive. Orchard sanitation and weed management are examples of cultural practices that influence pest abundance. Brown rot, plant bugs, stink bugs, mites and shot hole borers are among the peach pests influenced by cultural practices. Airblast pesticide application is the mainstay of orchard disease and insect control. **Complete sprays [COM (both sides of each tree row)]** with around 75 gallons of spray per acre is the standard recommended practice. Proper sprayer calibration and speed are important. Early season, prior to full leaf, it is easier to get thorough coverage. **Alternate-row-middle (ARM)** application, spraying every other row middle on an alternating basis, can be quite effective under the right conditions. ARM offers speed for responsiveness to wet weather, etc. However, ARM spray coverage is inherently less thorough. ARM works quite well for many growers during early-season. Mid-season ARM application can also be a worthwhile option when dry weather and low pest pressures reduce risk. As pest pressure increases, especially pre-harvest, it is essential to get thorough coverage. **COM sprays are recommended for pre-harvest applications/during emergence of scale crawlers, and when disease pressure is severe.** Slower application speeds offer improved coverage. Speeds as slow as 2.5 mph may be needed during wet weather to control epidemic levels of brown rot.

Bacterial spot is an erratic but severe disease. Select sites with heavier soils and use resistant cultivars to reduce disease. Stressed or unthrifty trees are predisposed to bacterial spot. An intense early-season program using copper products and later an antibiotic program is essential in bacterial spot susceptible cultivars. **Copper rates must be adjusted downward as tree phenology advances to avoid phytotoxicity.** Moisture strongly influences occurrence of bacterial spot infection. **Hail injury greatly increases the susceptibility of fruit to bacterial spot infection if the disease is present**

in the orchard prior to hail. As soon as possible after hail injury, make an application of Mycoshield 1.5 lb/acre in sufficient water to provide for thorough coverage of fruit and foliage. Injured fruit are also more susceptible to fungal rots, including the brown rot fungus. An effective MOA FRAC code 3 fungicide should be applied as soon as possible after hail injury. Note that propiconazole is not registered for use in cover sprays. Also, be aware that oxytetracycline (Mycoshield) does not control brown rot, nor does Indar control bacterial spot.

Blossom blight is an erratic disease in the Southeast. If brown rot pressure was light the previous season, the opportunity to omit blossom blight sprays exists. One or two preventative blossom blight sprays may be useful when infection periods develop during bloom. **Do not use MOA FRAC code 3 fungicides during bloom to reduce the brown rot resistance risk for these key fungicides.** Orchards may be scouted to assess the risk of blossom blight. If brown rot cankers, mummies in the tree or on the ground, fruit pedicel infections or brown rot were present the previous year, blossom blight sprays will be helpful. Where blossom blight sprays were omitted and blossom blight occurs, remedial action is warranted. For the next 8 to 10 weeks, select scab control fungicides that are effective for brown rot control.

White peach and San Jose scale are debilitating tree pests that can kill scaffolds and trees. In severe infestations, fruit are also infested. Dormant and delayed dormant oil applications are the bedrock of scale control. Every acre should be treated twice each dormant season with dormant horticultural oil. Dilute applications are ideally made 10-14 days apart. Fall applications applied during the first cool spell after full leaf drop is encouraged. In-season scale applications with Centaur, Esteem, Movento, or high rates of Imidan must be timed to coincide with crawler emergences to optimize effectiveness. Scale crawlers readily move from infested plants to adjacent orchards. Hedgerows with abundant privet and chinaberry are a problem. Where practical, push out scale-infested adjacent vegetation. Use of Ambush, Pounce, Warrior II, Silencer, or Sevin often promotes scale problems. Use scale-promoting insecticides on a strict as-needed basis – when REIs eliminate other more suitable alternatives.

Thrips are damaging to nectarine, primarily at bloom and to a lesser degree in mid- to late-May. Mild, dry winters and early springs increase flower thrips abundance. **Apply pink and petal fall thrips insecticides to nectarine during dry springs.** Silvering may develop on well-colored varieties that ripen in mid-May if thrips are abundant then.

Catfacing insects - Primarily the sucking bug complex of plant bugs and stink bugs are key pests that must be effectively controlled during early season to prevent scarring of fruit. The sucking bugs are less common in orchards with effective, broadcast control of annual, broadleaf weeds. Insecticide applications should begin at petal fall. Sometimes cold weather will delay or set-back crop phenology during this period. Once the initial petal fall application has been made, additional insecticide applications are typically warranted every 7-10 days.

Oriental fruit moth (OFM) is an erratic but potentially damaging pest. Early-season insecticides applied for sucking bugs and plum curculio normally provide excellent OFM control in much of the Southeast. In GA and SC, cultivars ripening after Harvester are more subject to OFM injury. A pheromone trap treatment threshold of 10 moths/trap/week should be used after 3rd cover. OFM begins emerging and mating shortly before or during bloom. Eggs hatch by mid- to late-April. In peach, first generation OFM larvae feed primarily on tender vegetative growth. Subsequent OFM generations feed inside fruit. The mature larva is 1/2" long, pinkish-white, has an anal comb, has legs and feeds in the fruit. Variable spring temperatures cause an erratic emergence and egg laying by first generation. The only certain way to distinguish between OFM moth and codling moth larvae is to use a hand lens to examine mature larvae for the presence of an anal comb. This is a dark, comb-like feature found on the last abdominal segment above the anus. Codling moth does not have an anal comb.

Oriental Fruit Moth Degree-Day Model

Deciding if and when to spray for OFM can be based on pheromone trap catches and a degree-day (DD) model. Pheromone traps are used to determine the starting point of the model (biofix) and to gauge the intensity of populations. The DD model predicts adult emergence and egg hatch for each of the 5 to 6 generations. The table below shows adult emergence and egg hatch predicted at various DD after biofix.

To use the OFM model, begin to accumulate daily DD when male flight begins in the spring (biofix). The biofix date is when pheromone traps detect the first sustained catch of two or more moths in the spring. The tables that follow use daily maximum and minimum temperatures to determine the daily DD for OFM (base 45°F). Traps should be placed in orchards near the *bud swell stage* and checked one to two times per week. Traps should be hung at eye-level at a density of 1-trap/10 acres of orchard. Check traps weekly after the biofix date.

First-Generation: Low OFM-density orchards are those with less than 0.5 percent of the fruit damaged the previous year and pheromone trap catches that do not exceed 10 moths/trap/week anytime before the accumulation of 500 DD after biofix. **In low OFM-density orchards, a single insecticide application can be applied against OFM at 600 DD after biofix. In moderate to high-density OFM orchards, two insecticide applications are applied 14 days apart, the first at 500 DD after biofix.**

(continues)

RELATIONSHIP BETWEEN DEGREE-DAY ACCUMULATIONS AFTER BIOFIX AND BIOLOGICAL EVENTS OF ORIENTAL FRUIT MOTH (45°F LOWER BASE, 90°F UPPER BASE)*	
Cumulative degree-days	Biological Event
175	first adult emergence
250	first eggs laid
325 to 425	peak adult emergence
525	peak egg laying
950	first emergence of second generation adults
1,100	first eggs laid by second generation
1,300 to 1,425	peak emergence of second generation adults
1,500	peak egg laying by second generation adults
1,900	first emergence of third generation adults
2,200 to 2,450	peak emergence of third generation adults
2,500	peak egg laying by third generation adults

* Modified from Michigan State University Fact Sheet



Second-Generation: *Extremely low-density OFM* orchards may not require an insecticide application (i.e., pheromone trap catches never exceed 3 moths/trap/week between 800 to 1,600 DD after biofix). **Low-density orchards may require one insecticide application at 1,400 DD after biofix given no sign of damage by first generation larvae and pheromone trap catches are between 3 to 7 moths/trap/week between 800 and 1,500 DD after biofix. Moderate to high-density OFM orchards will have fruit damage and/or higher pheromone trap catches requiring two insecticide applications 14 days apart starting at 1,400 DD after biofix.**

Third-Generation: **Recommend an insecticide application be made at 2,300 DD after biofix if OFM pheromone trap catches exceed 5 moths/trap/week after 1,900 DD after biofix and the existence of fruit damage caused by the second generation.**

Mating Disruption

OFM mating disruption saturates the orchard with pheromone to prevent mating and subsequent laying of fertile eggs. This reduces the populations to below economically damaging levels. **Mating disruption for OFM is effective only in blocks in excess of 5 acres with low populations.** A one-year transition from insecticide only to a combination of insecticide and mating disruption may be required in situations with moderate to high OFM pressure. Accurately time insecticide sprays targeted at larval populations in April and May.

Peachtree and lesser peachtree borer mating disruption may be effective when an areawide approach is established in order to encompass enough acreage to alleviate immigration of mated females from outside the treated area. One application of 150 dispensers/acre in early March may control both LPTB and PTB for that season.

Other pests

Peach scab is favored by cool, wet weather. Infection can take place from petal fall until 30 days pre-harvest. Shuck split through 2nd or 3rd cover is the period of heavy scab pressure. Hot dry weather reduces scab pressure. Early season cultivars may escape scab infection if fruit is harvested before the last week in May in Georgia or the first week of June in South Carolina.

Plum curculio is the most important fruit-feeding insect in the Southeast. Feeding injury by plum curculio is similar to, but much coarser than, sucking bug injury. Plum curculio egg laying is far more serious. Plum curculio adults are 1/4" long weevils with a curved snout, mottled black, gray and brown with two bumps on each wing cover and a white marking across the back. Adults overwinter in leaf litter in and around orchards. In the spring when the daily maximum temperature exceeds 70°F, adults emerge, mate and lay eggs under fruit skin. This occurs in February in Florida and as late as late-March in more northern sites from Arkansas to North Carolina. Eggs hatch within a few days after being laid and the larvae feed in the fruit. Mature larvae are 1/4" long, white, slightly curved, and legless. Larvae exit fruit, enter soil under trees to pupate and emerge as adults in May (Florida) and early June in more northern sites from Arkansas to North Carolina. There are at least 2 generations per year.

Scouting Options: By pink stage, place four pyramid traps next to trees along the perimeter of each orchard, wooded edge areas are best. After bloom, check pyramid traps twice weekly for plum curculio adults and check fruit for damage.

Control Alternatives: Trap-based treatment thresholds have performed well on farms where fruit are marketed locally. It is a high-risk approach for wholesale shippers. **Spray insecticide if you see any new fruit damage or if catches exceed 0.1 plum curculio adults/pyramid trap/week.** Keep trees protected with insecticide as long as adults are captured in traps. **Typically, growers begin sprays at petal fall and repeat every 10 to 14 days as long as new damage appears.**

Plum Curculio Degree-Day (DD) Model: With any model, use caution and try on a limited acreage until proven reliable in your area. This model helps growers prepare for plum curculio emergence, determine the end of adult movement in the spring, and eventually predict initiation of the June generation. Using the model—once buds swell, note the second date when air temperature exceeds 70°F (biofix) and begin accumulating daily DD (base 50°F) using the plum curculio DD table on next page, below. Adults emerge from 50 to 400 DD after biofix and damage occurs from 100 to 700 DD after biofix.

Borers are very serious tree pests. No effective controls are available for lesser peachtree borer in the Southeast. **Aggressive use of insecticides provides helpful suppression.** Peachtree borer treatment thresholds have not been developed, so annual, preventative barrier insecticides are recommended after harvest. See “Mating Disruption” above and/or the Post-Harvest borer section.



PLUM CURCULIO DEGREE DAYS (50°F LOWER BASE, 88°F UPPER BASE) AT VARIOUS DAILY MAXIMUM AND MINIMUM TEMPERATURES

Max Min	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96
20	0	1	1	2	2	3	3	4	5	5	6	7	8	9	9	10	11	12	13	14	15	15
22	2	1	1	2	2	3	3	4	6	6	6	7	8	9	10	10	11	12	13	14	15	15
24	0	1	1	2	2	3	4	4	6	6	7	7	8	9	10	11	11	12	13	14	15	16
26	0	1	1	2	2	3	4	4	6	6	7	7	8	9	10	11	12	12	13	14	15	16
28	0	1	1	2	2	3	4	4	6	6	7	8	8	9	10	11	12	13	14	15	15	16
30	0	1	1	2	2	3	4	5	6	6	7	8	9	10	10	11	12	13	14	15	16	16
32	0	1	1	2	3	3	4	5	6	6	7	8	9	10	11	11	12	13	14	15	16	17
34	0	1	1	2	3	3	4	5	6	7	7	8	9	10	11	12	13	14	14	15	16	17
36	0	1	1	2	3	4	4	5	6	7	8	8	9	10	11	12	13	14	15	16	17	17
38	0	1	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	18
40	0	1	2	2	3	4	5	6	6	7	8	9	10	11	12	13	14	15	16	17	17	18
42	0	1	2	2	3	4	5	6	7	7	8	9	10	11	12	13	14	15	16	17	18	19
44	0	1	2	3	3	4	5	6	7	8	9	10	11	12	13	14	15	15	16	17	18	19
46	0	1	2	3	4	5	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
48	1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	20
50	1	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
52	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
54	-	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
56	-	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
58	-	-	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
60	-	-	-	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
62	-	-	-	-	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
64	-	-	-	-	-	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
66	-	-	-	-	-	-	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
68	-	-	-	-	-	-	-	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
70	-	-	-	-	-	-	-	-	18	19	20	21	22	23	24	25	26	27	28	29	30	31
72	-	-	-	-	-	-	-	-	-	20	21	22	23	24	25	26	27	28	29	30	31	32
74	-	-	-	-	-	-	-	-	-	-	22	23	24	25	26	27	28	29	30	31	32	33
76	-	-	-	-	-	-	-	-	-	-	-	24	25	26	27	28	29	30	31	32	33	34

Peach red spot is a disease suspected to be caused by *Alternaria* species. Red spot appears as distinct 1/16 to 1/8 inch red spots, with occasional dead brown tissue in the center. In central GA, ziram applied beginning in mid-May, 2nd to 4th or 5th cover, often provides red spot suppression. Red spot is more severe on mid- to late-season yellow cultivars during periods of high humidity and extended morning fog.

Sooty peach may be caused by a complex of several epiphytic fungi that produce dark mycelial growth. They grow on the surface of fruits using nutrients and plant juices. Periods of high humidity and extended morning fog are conducive to sooty peach. Scale, mites, aphids and other insects can contribute to sooty peach development by damaging foliage and fruit, or producing honeydew, accumulating nutrients on the fruit surface which may be colonized by sooty peach fungi. **Ziram is the preferred fungicide for sooty peach.** Captan will suppress some, but not all, of the fungi in the sooty peach complex.

Green fruit rot and aborted, non-abscised, infected fruit are the in-season phases of brown rot. They are more common in wet summers. Green fruit rot infection is frequently associated with injuries. Green fruit rot and infected, aborted, non-abscised fruit are inoculum sources for latent brown rot infection. If wet weather prevails, these sources of inoculum will set the stage for epidemic level pre-harvest brown rot. Use of captan to enhance brown rot/scab control during the period is suggested if these sources of inoculum develop.

Brown rot is the most important fruit rot of peach. Thorough spray coverage with effective fungicides is essential to achieve commercial-level brown rot control. MOA 3 fungicides (such as Orbit, Cevya, Orius, Indar) are the mainstays of brown rot control. Resistance is an important threat. Some universities are able to screen brown rot for sensitivity to fungicides. A resistance management strategy should be developed based on knowledge of fungicide sensitivity to MOA 1, 2, 3, 7, and 11 fungicides in individual blocks. Your county agent and extension plant pathologist may be able to evaluate brown rot from individual blocks to determine brown rot sensitivity to fungicides. This must be done during the harvest season of early and mid-season cultivars in preparation for the next season and shift strategies in the current season. Knowing the resistance status of each of these fungicide groups allows tailoring of management programs to improve control and minimize further resistance development. Avoid use of MOA 3 products for control of blossom blight, green fruit rot or latent brown rot infections. **Hail injury greatly increases the susceptibility to brown rot. If blossom blight or sporulating brown rot cankers or infected, aborted, non-abscised fruit are present in blocks that receive hail injury, apply an effective MOA 3 fungicide as soon as possible after hail injury.** Note that propiconazole is not registered for use in cover sprays. Also, be aware that **oxytetracycline (Mycoshield) does not control brown rot, nor does Indar or Orius control bacterial spot.**

‘Determination of Resistance Profile’ is a science-based resistance monitoring program to identify effective and sustainable spray programs for brown rot control of peach.

Fungicide resistance development in *Monilinia*, the brown rot fungus of peach and other stone fruits, is increasing in the Southeast. As a consequence, spraying the wrong product may cause devastating losses to your crop. This development can be stopped by implementing effective anti-resistance spray strategies. The resistance monitoring program was developed by Clemson University and University of Georgia scientists to manage existing and emerging fungicide resistance in the brown rot fungus. It can identify the cheapest effective spray program for brown rot control for your operation based on your individualized resistance profile. In addition, it counteracts selection for fungicide resistance, making disease management and your operation more sustainable for the future.

The program determines the sensitivity of the local *Monilinia* population to the most commonly used fungicide classes for brown rot management: the MOA 1 (e.g., Topsin M), the MOA 3 (e.g., Tilt), the MOA 7 (e.g., boscalid in Pristine) and the MOA 11 (e.g., pyraclostrobin in Pristine) fungicides. The pathogen is collected once or twice a year from multiple farm locations and subjected to specific discriminatory doses of fungicides in a poison agar assay. After three days of incubation, the ability of the fungus to grow on fungicide-amended growth medium is assessed. If the fungus grows on fungicide-amended medium, it is considered resistant. The resistance profile may change from one season to another depending on the spray history. For more information contact Guido Schnabel 864-656-6705; 864-643-7131 (cell); schnabe@clemson.edu.

Rhizopus rot and Gilbertella rot occur on mature fruit. The skin over *Rhizopus* and *Gilbertella* lesions easily slips from the rotted flesh. Skin slippage does not readily occur over brown rot lesions. Sanitation is the key to control of *Rhizopus* and *Gilbertella* rots. Pristine, Merivon, Luna Sensation and **Orius** (high rate) are the fungicides of choice.

Pocket rots (anthracnose, *Phomopsis*, *Botryosphaeria*) produce rots where the affected flesh easily separates from surrounding healthy tissue to create a pocket. Inoculum for *Phomopsis* pocket rot develops in twig cankers. Orchards should be scouted for these rots. Fruits thought to be infested should be sent to an extension plant pathologist for identification of the rot. **Anthracnose requires use of captan sprays beginning at least six weeks prior to harvest. *Phomopsis* or *Botryosphaeria* pocket rots are best managed with a tank mix of Topsin-M plus captan, beginning six weeks before harvest.**

Powdery mildew is a dry weather pest. During ‘normal’ springs, with variable wet and dry, cool and warm conditions, sulfur provides adequate control. In dry springs, sulfur may not provide adequate control of powdery mildew, especially if the mildew comes in at petal fall or shuck split – when fungicides like chlorothalonil or captan are recommended for better scab efficacy. Other fungicides for powdery mildew include DMIs (FRAC 3), SDHIs (FRAC 7), and QoIs (FRAC 11) fungicides. Some varieties are consistently more susceptible to powdery mildew, and incorporation of other fungicides in the early season may be required to reduce damage.

Rusty spot (powdery mildew) is characterized by white patches of fungal mycelium that turn into necrotic patches in late May or early June. In blocks with damaging rusty spot, application of DMIs (FRAC 3), SDHIs (FRAC 7), and QoIs (FRAC 11) fungicides from shuck off through 3rd cover should be helpful.

Phomopsis twig blight – There is no effective disease management strategy for this disease. Do not select susceptible cultivars. Make sure source of scion wood of susceptible cultivars is from disease-free source. Remove/clean all twigs and branches from all equipment before entering susceptible blocks.

RESISTANCE MANAGEMENT

Reducing the Risk of Pesticide Resistance

Mode-of-action describes how a pesticide attacks an organism. Pesticides often target highly specific life processes. In peaches, key fungal pathogens--brown rot and scab--are very adept at developing resistance to certain fungicide classes. Fortunately, key insect pests have remained susceptible to organophosphate insecticides despite heavy use for some 40 years. Repetitive exposure of resistance-prone pests to pesticide with limited-site mode-of-action encourages resistance development. Resistance can develop simultaneously within entire classes because classes share a common toxic mode-of-action. **Alternating pesticide groups or classes reduces resistance risk.** Peach fungicides with limited-site mode-of-action should be alternated with fungicides having a different mode-of-action. Fungicides in the same class should not be alternated. Important fungicide classes like the DMIs and QoIs should be used judiciously to lower selection for resistance. Restricting DMI and QoI use to the pre-harvest season is strongly encouraged.

Use of multi-site fungicides (captan, chlorothalonil, ziram) is encouraged as a means of complementing the resistance management offered by alternating key materials during the pre-harvest period. In addition to alternating between fungicide classes, consideration should be given to using multi-site fungicides as part of a resistance management strategy. Tank mixes of different classes are effective in slowing resistance development if synergism is present, but no cases of synergism are known at this time. Resistance is less likely to occur in microorganisms and insects that are maintained at low populations. Timely sprays to prevent pest population buildup will slow resistance development. Rescue treatments applied to out-of-control pest populations increase the chance of resistance selection in the pest.

ORCHARD WEED MANAGEMENT STRATEGIES

Orchard Floor Management

Management of grasses and broadleaf plants in the orchard floor is an important component of peach culture. Weed control has progressed to orchard floor management (OFM). Herbicide-based management programs have replaced cultivation as the mainstay of orchard weed control. Cultivation damages feeder roots and has been linked to increased occurrence of peach tree short life. Cultivation also promotes soil compaction, erosion and mechanical injuries associated with operator error.

Maintenance of a non-competitive grass alley with a vegetation-free strip in the tree row is the orchard floor management standard for commercial peach production. This approach uses herbicides to establish and maintain a vegetation-free strip in the tree row. A grass alley between the tree rows serves to minimize soil erosion, increase soil aeration and permeability, and support equipment movement in the orchard. The grass alley may be a perennial grass sod, small grain cover crop, or native vegetation. Broadleaf weeds should be controlled in the grass alley and in the tree row to make the orchard less attractive to cat-facing insects and mites. The vegetation-free strip in the tree row reduces competition for water and nutrients, provides some radiant heat from the soil surface during spring frost/freezing events, and removes winter hosts for catfacing insects. Herbicides are directed at the soil and weeds underneath the tree to maintain the vegetation-free strip. 2,4-D amine or Embed applied 6-8 weeks prior to bloom will control winter annual weeds in the row middle without damaging the sod or small grain cover crop. In addition to 2,4-D amine or Embed, clopyralid may be used as well. Clopyralid may be applied alone or tank mixed with 2,4-D amine or Embed for broader spectrum broadleaf weed control. In production areas where there is no established sod (only native vegetation) in the row middles the addition of rimsulfuron with 2,4-D amine will improve postemergence control of chickweed and henbit. This OFM strategy, coupled with frequent, close mowing of row middles and the perimeter of orchards is essential for developing and maintaining an effective vole control program in orchards.

Orchards should be scouted regularly to determine weed species present. Scouting allows growers to tailor OFM options to the needs of individual blocks, as well as improving control of escaped weeds with a timely post-emergence herbicide treatment. Early identification of problem weeds can prevent them from establishing. When problem weeds are first noticed in an orchard, take steps to eliminate them before they produce seed. Scouting gives growers an opportunity to recognize poorly controlled weeds so weed management programs can be adjusted. Another aspect growers should consider is the potential for infestation by weeds located around orchard borders. Weeds in these areas produce seed that will find their way into the orchard for germination in the future.

Herbicide Considerations

Labels are legally binding and have precedence over any recommendation in this publication. Application equipment should be calibrated regularly to prevent over- and under-application.

Peach growers have a number of herbicides available for weed control in orchards. Pre-emergence herbicides control germinating weed seeds. In order for pre-emergence herbicides to work properly, activation from rainfall or overhead irrigation must occur. Most pre-emergence herbicides need to be activated by rain or irrigation within 7 to 14 days of application. Refer to product labels for preferred interval after application for activation; however, the sooner activation occurs after application the better the herbicide activity. Pre-emergence herbicide rates vary with soil texture and soil organic matter. Rates should be adjusted for the soil type(s) in your orchard(s).

Post-emergence herbicides control emerged, actively growing weeds. It is important that post-emergence herbicides be applied in a timely manner. Applications to large weeds or weeds in other non-susceptible growth stages will result in poor control. Optimum application times (height, growth stage, etc.) can be found on product labels. Avoid applying herbicides to stressed weeds. Mowed weeds should be allowed to re-grow before herbicide application. If weeds have been under drought stress, wait several days after rainfall until weeds are no longer wilted and are actively growing.

Orchard Floor Management in Newly Planted Orchards

Eliminating weed competition is essential in newly planted trees to promote optimal tree growth and future productivity. Research has shown that weed competition to young trees can result in a 50% reduction in tree growth, which drastically reduces future yield. Newly planted orchards are most prone to weed competition and young trees do not compete well for moisture or nutrients. Pre-emergence herbicides registered for use after transplanting generally provide effective control of annual grasses and small seeded broadleaf weeds. Large seeded broadleaf weeds and perennial grass weeds will have to be controlled with post-emergence herbicides. **Painting the lower 18" of the tree trunk with a white latex paint is highly recommended. The paint provides a barrier to herbicides, protecting tender, green bark from serious injury, as well as reducing sun scald and winter injury. In newly planted orchards, growers have attempted to narrow the herbicide strip width until trees get larger. This practice is not recommended because research has shown that newly planted trees need a 12-ft. wide herbicide strip to maximize growth. In orchards having microsprinkler irrigation, herbicide strip width can be reduced to 8 to 10 ft.**

Orchard Floor Management in Established Orchards

A good orchard floor management program in established orchards starts in the fall with a pre-emergence herbicide application in the tree row. In areas where camphorweed is a problem, simazine or Solicam is preferred. This application will maintain the herbicide strip free of weeds through bloom, allowing for radiated heating during spring freeze events. The row middles should be treated with post-emergence herbicides prior to bloom to eliminate winter annual broadleaf weeds that are hosts to catfacing insects. This practice is known to considerably reduce catfacing insect pressure and is part of an integrated approach to managing these pests. After bloom, another pre-emergence herbicide application should be made to the herbicide strip to provide residual control of emerging summer annual weeds. It may be necessary to follow up with post-emergence herbicides to control escaped weeds or perennial grass species like bermudagrass or Johnsongrass. Research in NC has shown that failure to maintain the herbicide strip free of weeds to within four weeks of peach harvest will result in marketable fruit losses and reduced peach size.

Managing the Orchard Floor for Maximum Radiant Heat Benefit and Reduce the Orchard's Attractiveness to Plant Bugs and Stink Bugs

Bare soil surfaces collect heat from sunlight, which is released at night. This is known as radiant heating. By minimizing vegetation on the orchard floor, growers take advantage of radiant heating and elevate orchard temperatures during spring freeze events. Fall applied pre-emergence herbicides will maintain a bare soil surface in the tree row through spring. Drive alleys planted in small grain cover crops or perennial grasses should be closely mowed several days prior to bud break to assist with the radiant heat benefit. In orchards where no permanent vegetation is planted in the drive alley, a broadcast application of paraquat, glyphosate, glyphosate + 2,4-D, glufosinate, or glufosinate + 2,4-D may be used to chemically mow. The absence of flowering broadleaf weeds lowers catfacing injury from plant bugs and stink bugs.

Herbicide Carryover in Young Orchards

Growers attempting to establish a new orchard need to know the herbicide history of the field prior to orchard establishment. A number of herbicides used in agronomic crops, pasture or hay fields, or on turf farms can persist in the soil for long periods of time. Herbicide carryover can reduce tree growth, cause significant tree damage and, in severe incidence, tree death. The persistence of a herbicide varies with the specific herbicide used in the previous cropping situation. Picloram (Grazon or Tordon) can persist for up to 5 years after application. Products like imazapic (Cadre or Plateau) and other imidiazolinone herbicides can persist for 24 to 36 months. Many herbicides do not persist or persist for a matter of a few weeks. In addition to the herbicide, factors such as temperature, soil pH, and rainfall affect herbicide persistence.

Herbicide Resistant Weeds

The reality of herbicide resistant weeds infesting orchards is more likely today than ever. It was documented several years ago that pigweed and goosegrass populations resistant to dinitroaniline herbicides (pendimethalin and oryzalin) exist in the Southeast. Populations of Johnsongrass resistant to carboxylase herbicides (Fusilade DX) have also been documented. Most recently, glyphosate-resistant weeds have been found across the Southeast and Midwest. Glyphosate-resistant weed populations have been verified throughout the United States. The two most notable species developing resistance to glyphosate are horseweed and Palmer amaranth. Glyphosate-resistant ragweed and giant ragweed has been documented as well. Growers should be aware that these weeds are in peach production regions and, in the event of control failures, herbicide programs will have to be altered. If you suspect a problem or need additional information, you should contact your county agent with the Cooperative Extension Service. Expansion of glufosinate (Rely and many others) product's label to allow its use in peach orchards provides an additional non-selective POST herbicide option to control glyphosate resistant weeds. Additionally, the registration of Embed (2,4-D choline) in peach will also aid in the management of glyphosate resistant weeds as well.

In order to prevent the development of herbicide-resistant weeds, growers should take into consideration the following practices.

1. Rotate herbicides with different modes of action. For example, do not use simazine (Princep, Simazine) continuously. Consider other pre-emergence broadleaf herbicide options. Avoid making more than two applications of the same herbicide in the same year.
2. Tank mix herbicides using multiple modes of action (MOA).
3. Scout orchards to identify weeds. Respond quickly to changes in weed population by controlling weeds before they spread throughout the entire orchard.
4. Use non-selective post-emergence herbicides in a weed management program.
5. Use herbicides only as-needed.

As a means to assist growers with identifying herbicides having like MOA, a number system identifying herbicides by MOA has been developed and is being utilized. In the table below, there is a MOA number for each herbicide active ingredient to aid growers in making management decisions that will prevent the development of herbicide resistance or address options for managing a known resistant weed population that may be in or near the fruit planting.

HERBICIDE RECOMMENDATIONS

Use Stage and Herbicide	Broadcast Rate/Acre		Remarks and Precautions
	Amount of Formulation	Lb Active Ingredient	
Pre-emergence			
<i>flumioxazin</i> (MOA 14) Flumi 51 WDG Tuscany 51 WDG Tuscany 4 SC Chateau EZ	6 - 12 oz 6 to 12 oz 6 to 12 oz 6 to 12 fl oz	0.19 - 0.38	Use for residual control of annual broadleaf and grass weeds. In newly planted orchards, best results have been obtained when an initial application of flumioxazin (6 to 8 oz) is applied, followed by a second application when weed control from the initial application begins to fail. When flumioxazin is used after bud break in non-bearing orchards, application equipment must be hooded. Do not apply the second application within 30 days of the initial application. Trees established less than 1 year must be protected with a non-porous wrap, grow tube, or waxed container. Newly planted trees may be treated after transplanting once soil has been allowed to settle. In orchards expected to produce fruit, flumioxazin can only be applied after final harvest up until bud break due to concerns related to fruit speckling from flumioxazin drift. Do not apply within 60 days of harvest. Flumioxazin may be tank mixed with paraquat, glyphosate, or 2,4-D amine for post-emergence weed control. Total use rate cannot exceed 24 oz per acre per year. Flumioxazin applied at 6 to 8 oz per acre will provide 60 to 80 days of residual control when it is properly activated with rainfall. In order to get residual control beyond 80 days, flumioxazin will need to be applied at 10 to 12 oz per acre.
<i>pendimethalin</i> (MOA 3) Prowl H ₂ O or Satellite HydroCap	2 - 4 qt	2 - 4	<u>DO NOT</u> apply to newly planted trees until the soil has settled and no cracks are present. Adequate rainfall or irrigation within 7 days of application is necessary for optimum herbicide performance. Apply in combination with non-selective POST herbicide for control of emerged weeds. The pre-harvest interval for pendimethalin in stone fruit is 60 days. Appropriate pre-emergence tank mix partners include simazine and rimsulfuron. Sequential applications may be used so long as total use rate does not exceed 4.2 qt/A per year. Allow at least 30 days between applications. All other formulations of pendimethalin may be used in non-bearing orchards only.
<i>diuron</i> (MOA 7) Karmex XP, Diuron 80DF Direx 4L	2.0 - 2.75 lb 1.6 - 2.2 qt	1.6 - 3.2	Use for control of annual broadleaf weeds <u>ONLY</u> under trees established in the orchard for at least 3 years (2 years in GA). May be applied as a fall/spring split in Georgia only. <u>DO NOT</u> use on sand, loamy sand, gravelly soils, or exposed subsoils. Do not use on soils with less than 1% organic matter. Addition of a surfactant will provide burn-down action. Karmex DF and Direx 4L have a 20-day PHI. Other diuron formulations may have a 90 day PHI.
<i>fluridone</i> (MOA 12) Brake On!	21 - 43 fl. oz	0.2 - 0.4	Brake On provides PRE control of annual broadleaf and grass weeds like horseweed, palmer amaranth, lambsquarter, ragweed prickly sida, crabgrass, goosegrass, and fall panicum. Trees must be established for at least 1 year prior to applying Brake On. Do not apply more than 43 fl oz of this product per acre or make more than 1 application per calendar year. The PHI for Brake On is 30 days. Brake On herbicide cannot be applied more than 2 consecutive years in the same orchard. Brake On may be tank mixed with glufosinate, paraquat, rimsulfuron, diuron, or pendimethalin.
<i>indaziflam</i> (MOA 29) Alion 1.67 SC	3.5 - 6.5 fl oz	0.046-0.084	Use in peach orchards established 3 years or longer. The use rate cannot exceed 3.5 fl. oz/A per application (total use cannot exceed 7 fl. oz/A per year when applying sequential applications) on soils having less than 1% organic matter. Soils having 1 to 3% organic matter can be treated with 3.5 to 5 fl. oz/A per application (total use cannot exceed 8.5 fl. oz/A per year when applying sequential applications). As much as 6.5 fl. oz/A per application (total use cannot exceed 10.3 fl. oz/A per year when applying sequential applications) can be applied to soils having more than 3% organic matter. Do not use on soils having a 20% or greater gravel content. Research has shown Alion applied in the fall followed by a late spring application will provide summer long control of annual broadleaf and grass weeds. Allow at least 90 days between sequential applications. Do not treat soil around trees with cracks, or channels, or with depressions. Alion should be tank mixed with glyphosate or paraquat for non-selective POST weed control. Alion has a 14 day PHI. Significant amounts of plant debris or weeds preventing uniform herbicide contact with soil surface may reduce herbicide effectiveness. See label for details regarding replant management in established orchards.

HERBICIDE RECOMMENDATIONS (*continued*)

Use Stage and Herbicide	Broadcast Rate/Acre		Remarks and Precautions
	Amount of Formulation	Lb Active Ingredient	
Pre-emergence (<i>continued</i>)			
<i>simazine</i> (MOA 5) Princep, Simazine 4L Princep, Simazine 90DG	2 - 4 qt 2.2 - 4.4 lb	2 - 4	Use for control of annual broadleaf weeds <u>ONLY</u> under trees established in the orchard for at least 1 year. Apply only once per year. Use the low rate on coarse textured soils. Some chlorosis may be observed in areas where little or no topsoil is present. <u>DO NOT</u> apply to gravelly, sandy, or loamy sand soils. Add paraquat for control of emerged weeds. Tank mixing simazine with pendimethalin, or Solicam will greatly improve residual control of annual grass weeds.
<i>pendimethalin</i> (MOA 3) Prowl H2O Satellite HydroCap 4AS plus <i>simazine</i> (MOA 5) Princep, Simazine 4L Princep, Simazine 90DG	2 - 4 qt 1.6 - 4 qt 1.75 - 4.4 lb	2 - 4 1.6 - 4 1.6 - 4	Use for broad spectrum annual grass and broadleaf weed control under trees established in the orchard for at least 1 year. Apply in spring before annual weeds emerge. <u>DO NOT</u> apply to gravelly, sandy, or loamy sand soils. Add paraquat or glyphosate for control of emerged weeds.
<i>penoxsulam + oxflurorfen</i> (MOA 2 & 4) Pindar GT	1.5 to 3 pt	0.015 + 0.75 to 0.03 to 1.5	Pindar GT is not cleared for use ALL states. The oxyfluorfen component of Pindar GT will provide postemergence control of certain weeds as well as aid the residual control of susceptible species. When applying alone or in combination with paraquat the addition of methylated seed oil @ 1 qt/A or a non-ionic surfactant @ 0.25 % v/v (1 qt/100gal of spray solution) will be necessary for optimum POST weed control. If tank mixing with glyphosate or glufosinate follow spray additive recommendations on those product labels. DO NOT apply to trees established less than 4 years. Pindar GT can only be applied in late fall (November thru bud swell). Tank mixing with either pendimethalin or Solicam will be necessary with late winter applications in order to provide adequate residual control of annual grass weeds.
<i>rimsulfuron</i> (MOA 2) Grapple 25 WDG Matrix 25 WDG Solida 25 WDG Pruvin 25 WDG	4 oz	0.0625	Apply as a band or broadcast application. DO NOT apply within 14 days of harvest. Rainfall within 3 weeks of application is necessary for optimum herbicide performance. Spray solutions must have a pH ranging from 4.0 to 8.0 to prevent herbicide degradation. Rimsulfuron has post-emergence activity on certain weeds including henbit, common chickweed, horseweed, wild mustard, wild radish, and pigweed species. Rimsulfuron may be tank mixed with pendimethalin, Solicam, diuron, Sinbar, glyphosate, or paraquat. Tree must be established for at least 1 year. Rimsulfuron has a 14 day PHI and sequential applications can be made so long as total use rate does not exceed 4 oz/A per year and application is made in a band on less than 50% of the orchard floor. Rimsulfuron will provide POST control of certain weeds (see label for details). POST horseweed control can be obtained when rimsulfuron is applied to horseweed <3" tall and a non-ionic surfactant with spray grade ammonium sulfate (2 lb/A) is used as a spray additive.
<i>rimsulfuron</i> (MOA 2) Grapple, Matrix, Solida, or Pruvin 25 WDG plus <i>Pendimethalin</i> (MOA 3) Prowl H ₂ O or Satellite HydroCap	4 oz 3 to 4 qt	0.0625 3 to 4	Tank mix with glyphosate or paraquat for non-selective POST weed control.
<i>terbacil</i> (MOA 5) Sinbar 80 WDG	0.5 - 1.0 lb	0.4 - 0.8	THIS USE ONLY APPROVED FOR NEWLY PLANTED OR NON-BEARING ORCHARDS. Apply once soil has settled after transplanting. Apply no more than 1 lb per acre per year. For best results apply 0.5 lb in late winter or early spring followed by another 0.5 lb when control from the initial application fails. Do not apply to soils coarser than sandy loam having < 2% organic matter. Tank mix with paraquat for non-selective POST weed control.

HERBICIDE RECOMMENDATIONS (*continued*)

Use Stage and Herbicide	Broadcast Rate/Acre		Remarks and Precautions
	Amount of Formulation	Lb Active Ingredient	
Pre-emergence (<i>continued</i>)			
<i>terbacil</i> (MOA 5) Sinbar 80W	2 – 4 lb	1.6 – 3.6	Use for annual weed control and perennial broadleaf weed suppression. Use only under trees in BEARING ORCHARDS that have been established for at least 3 years. Apply in the spring or after harvest in the fall before weeds emerge or before weeds exceed 2” tall. Some chlorosis of weakened trees may occur. <u>DO NOT</u> use on sand, loamy sand, or gravelly soils or on eroded areas where tree roots are exposed. Rate is soil texture dependent. See label for details. <u>DO NOT</u> use on any soil with less than 1% organic matter. Use rate cannot exceed 3 lb/A unless soil organic matter is >2%. Sinbar tank mixed with rimsulfuron or diuron provides excellent residual control of broadleaf and grass weeds.
<i>terbacil</i> (MOA 5) Sinbar 80W plus <i>rimsulfuron</i> (MOA 2) Grapple, Matrix, Solida, or Pruvin	2 lb 2 oz	1.6 0.0313	Trials conducted in NC and SC have consistently shown Sinbar tank mixed with a half rate of rimsulfuron provides excellent long-term control of annual grass and broadleaf weeds. Tank mix with glyphosate or paraquat for non-selective POST weed control.
<i>diuron</i> (MOA 7) Karmex, Diuron 80DF plus <i>terbacil</i> (MOA 5) Sinbar 80W	1 - 2 lb 1 - 2 lb	0.8 - 1.6 0.8 - 1.6	Use for broad spectrum weed control <u>only</u> under trees established in the orchard for <u>at least 1 year</u> . Apply in spring or after harvest in the fall before weeds emerge or after weeds emerge but are less than 2” tall. Research has shown this combination provides a longer period of weed control and controls a broader weed spectrum than either component herbicide used alone. <u>DO NOT</u> use on sandy, loamy sand, or gravelly soils or on eroded areas where subsoil or tree roots are exposed. <u>DO NOT</u> use on any soil with less than 1% organic matter.
<i>norflurazon</i> (MOA 12) Solicam 80DF	2.5 - 5 lb	2 - 4	Use for control of annual grasses, broadleaf weeds, and suppression of some perennials. Do not apply to newly transplanted trees until 6 months after planting. Apply to soil that is firm and free of depressions in which rain or irrigation water could accumulate. Apply either post-harvest in fall or in early spring. Fall applications control a broader weed spectrum than spring applications. Use the low rate on coarse textured soils; high rate on fine textured soils. May be tank mixed with simazine for broader spectrum weed control. Add paraquat for control of emerged weeds. Rapidly hydrolyzed in soil, use low rates and split applications for maximum effectiveness.
<i>norflurazon</i> (MOA 12) Solicam 80DF plus <i>simazine</i> (MOA 5) Princep, Simazine 4L Princep, Simazine 90DG	2.5 - 5 lb 1.6 - 4 qt 1.75 - 4.4 lb	2 - 4 1 - 4	Apply in combination for broad spectrum pre-emergence control of annual grasses and broadleaf weeds. Trees must be established in the orchard at least 1 year. Apply in combination with paraquat for control of emerged weeds.
<i>norflurazon</i> (MOA 12) Solicam 80DF plus <i>diuron</i> (MOA 7) Karmex, Diuron 80DF	2.5 - 5 lb 2.0 – 4.0 lb (3 lb max in GA)	2 - 4 1.6 - 3.2	Trees must be established in orchard for 3 yrs. Apply combination with non-selective post-emergence herbicide for control of emerged weeds.
<i>indaziflam + rimsulfuron</i> (MOA 29 and 2) Centrus WDG	3 to 5.6 oz	0.076-0.143	Centrus is premix of Alion with rimsulfuron (Matrix and others) that provides PRE and POST control of annual weeds. Do not use on soils with 20% or greater gravel content. Use on trees established 3 years or longer. Do not apply within 14 days of harvest. Tank mix with glufosinate, paraquat, or glyphosate for non-selective POST weed control.

HERBICIDE RECOMMENDATIONS (continued)

Use Stage and Herbicide	Broadcast Rate/Acre		Remarks and Precautions
	Amount of Formulation	Lb Active Ingredient	
Post-emergence			
2,4-D amine (MOA 4) Various brands	2 - 3 pt	0.95 - 1.4	Use for control of cool season, annual broadleaf weeds such as dandelion, vetch and plantains. Do not contact peach foliage, limbs or stems. DO NOT use on newly planted trees. DO NOT apply more than 2 times per season or within 2 weeks of bloom. Some formulations may limit rate to 2 pt/acre. Due to the potential for drift, 2,4-D amine should only be used during the winter while peach trees are dormant.
2, 4-D Choline (MOA 4) Embed 3.8 L	1 to 4 pt	0.48 – 1.9	Embed contains 2, 4-D Choline which is a specific formulation of 2, 4-D designed to minimize drift and volatility. Two years of research in SC has shown that when applied during hot, summer time conditions peach trees have not been injured by Embed. See label for specific information pertaining to minimizing drift. Use coarse, low pressure sprays. DO NOT use in orchards established less than 1 year. DO NOT make more than 2 applications (of any 2,4-D herbicide) per year. Embed has a 40-day PHI for stone fruit. Allow at least 70 days between applications of Embed. Embed may be tank mixed with glyphosate or glufosinate for improved control of certain weeds and aid in the management of herbicide resistant weeds as well as prevent the development of herbicide resistant biotypes. Embed may not be registered for use on stone fruit in all states.
Bentazon (MOA 6) Broadloom 4L	1 to 2 pt	0.5 to 1	For application in NON-BEARING orchard ONLY! Apply in a minimum spray volume of 20 gpa. The addition of crop oil concentrate at 1% v/v (1 gal per 100 gal of spray solution). Is necessary for optimum herbicide performance. Do not apply more than 2 pts per acre per application or exceed 2 lbs ai per acre per year. Yellow nutsedge can be controlled with Broadloom when it is applied to plants having 4 to 6 leaves and less than 6" tall. An initial application is applied at a rate of 2 pts/acre with crop oil followed by second application of the same 10 days later.
carfentrazone (MOA 14) Aim 2EC	0.5 – 2 oz	0.008 - 0.031	Apply alone or tank mix with pre-emergence herbicides. Apply in a minimum spray volume of 20 gpa. Do not allow Aim to contact green bark or desirable foliage or fruit. Trees 2-years-old and younger must be protected with a shield or painted to prevent injury. Do not apply within 30 days of harvest. Best results are obtained when weeds are at the 2 to 3 leaf stage. Apply in combination with a non-ionic surfactant (1 qt/100 gal of spray solution) or crop oil concentrate (1 gal/100 gal of spray solution). The addition of Aim to glyphosate will improve post-emergence control of morning glory. Sequential applications may be used so long as there is at least 14 days between applications and total use rate for the year does not exceed 7.9 fl oz/A.
clopyralid (MOA 4) Stinger 3.0 lb/gal	1/3 – 2/3 pt	0.125 - 0.25	Apply post-emergence to actively growing weeds. Make no more than 4 applications per year, not to exceed 2/3 pt/acre/yr. Do not apply within 30 days of harvest. Stinger is very effective on leguminous weeds (clover, vetch, etc.). It may be tank mixed with 2,4-D to improve control of clover. Stinger can be tank mixed with pre-emergence herbicides.
Mesotrione (MOA 27) Motif 4F	3 to 6 fl oz	0.094 to 0.188	Motif will provide POST and some PRE control of certain broadleaf weeds. It may be applied as a directed spray in orchards established 12 months or longer. The PHI for Motif is 30 days. In order to maximize POST weed control activity use in combination with ammonium sulfate and a crop oil concentrate or non-ionic surfactant. Tank mix options include diuron, glufosinate, glyphosate, Alion, paraquat, pendimethalin, rimsulfuron, or simazine.

HERBICIDE RECOMMENDATIONS (*continued*)

Use Stage and Herbicide	Broadcast Rate/Acre		Remarks and Precautions
	Amount of Formulation	Lb Active Ingredient	
Post-emergence (<i>continued</i>)			
<i>paraquat</i> (MOA 22) Firestorm or Parazone or Paraquat Concentrate or Gramoxone 3 SL	2.5 – 4.0 pt 1.75 – 2.7 pt	0.6 - 0.9	Use for broad spectrum, contact control of emerged weeds. Apply as a directed spray in high spray volumes (20+ gpa) with 1 qt surfactant/100 gal of spray solution. Apply when broadleaf weeds and annual grasses are succulent and 1” to 6” tall. DO NOT allow spray drift to contact foliage or green bark of trees since severe damage may occur. May be tank mixed with certain pre-emergence herbicides to provide post-emergence and residual weed control. Paraquat has a 14-day PHI for peach and a 29-day PHI for nectarine.
<i>glyphosate</i> (MOA 9) Various formulations and concentrations	See label for rates	0.5 - 2	Apply while trees are dormant through early spring. Do not make applications later than 90 days after bloom. Apply with a shielded boom that prevents any contact of this product with tree foliage, bark or exposed roots. Suckers and low hanging limbs should be removed at least 10 days before application. Avoid making applications near recently pruned trees. Apply to trees established in the orchard at least 2 years. EXTREME care must be taken to prevent any contact of the spray solution with the tree or SEVERE INJURY can occur. Tank mix with pre-emergence herbicides for residual weed control. Generic glyphosate formulations may require the addition of a surfactant. See labels for details.
<i>glufosinate</i> (MOA 10) Lifeline Reckon 280 SL Rely 280 SL Surmise	48 to 82 fl. oz	0.88 to 1.5	DO NOT SPRAY GREEN BARK, UNCALLED BARK OR DESIRABLE FOLIAGE UNLESS TREES ARE PROTECTED. Glufosinate should not be used on trees within 1 year of transplanting. Apply in a minimum of 20 gallons of water per acre as a directed spray under trees. Repeat applications may be necessary for control of perennial weeds. Glufosinate can be tank mixed with diuron, Sinbar, Solicam, pendimethalin, oxyfluorfen, rimsulfuron, simazine, flumioxazin, or 2,4-D amine. Glufosinate has a 14-day PHI. Do not apply more 164 fl. oz/A within a 12-month period. Allow at least 28 days between applications. Glufosinate formulations contain surfactant, therefore additional nonionic surfactants or crop oils are not necessary and may increase potential for injury. Glufosinate will control glyphosate resistant weeds.
<i>fluazifop</i> (MOA 1) Fusilade DX 2.0 lb/gal	8 - 24 oz	0.13 - 0.38	Use for control of annual and perennial grasses in BEARING or non-bearing trees. Low spray volumes (10 gpa) generally improve control. Add crop oil concentrate (1 gal/100 gal of spray solution). Make application to Johnsongrass – 12” to 18” tall; bermudagrass – 3” tall or with 4” to 8” runners; annual grasses – 2” to 4” tall. Does not control nutsedge(s). Do not apply within 14 days of harvest. For control of perennial grasses, multiple applications may be necessary.
<i>sethoxydim</i> (MOA 1) Poast 1.5 lb/gal	1.0 - 2.5 pt	0.19 - 0.5	Use for control of annual and perennial grasses. Low spray volumes (10 gpa) generally improve control. Add crop oil concentrate (1 qt/acre). Use low rate on annual grasses up to 6” tall; higher rates on larger annual grasses and perennial grasses. Does not control nutsedge(s). For control of perennial grasses, multiple applications may be necessary. Poast has a 25-day PHI for peach and nectarine. It can only be used in NONBEARING plum.
<i>clethodim</i> (MOA 1) Clethodim 2 EC, Select 2EC, Intensity 2EC, or Arrow 2EC Select Max or Intensity One	6 - 8 oz 12 -16 oz	0.095 - 0.125	Use for control of annual and perennial grasses. Use higher rates for perennial grasses. Add crop oil concentrate (1 gal/100 gal of spray solution, but not less than 1 pt/acre). Make application to Johnsongrass – 12” to 18” tall; bermudagrass – 3” tall or with 4” to 8” runners; annual grasses – 2” to 8” tall. Clethodim does not control nutsedge(s). Sequential applications will be necessary for perennial grass control. For Select Max, add a surfactant at 0.25% v/v (1 qt/100 gal of spray solution). Select Max has a 14-day PHI for peach and can only be used on non-bearing nectarine and plum. All other formulations are registered for use in only nonbearing peach, plum, and nectarine plantings.

NEMATODE CONTROL ON PEACHES

Pre-plant Soil Fumigation

Pre-plant soil fumigation and the use of appropriate rootstocks are strongly encouraged on light, sandy soil where root-knot, root-lesion or ring nematodes are present. On many sites pre-plant fumigation is imperative to achieve reasonable orchard productivity and longevity. February-April samples provide the most accurate assessments of ring nematodes. September-October samples give the best assessments of root-knot and root-lesion nematodes. If nematode assays indicate the presence of root-knot, root-lesion or ring nematodes, it will be advantageous to fumigate the entire orchard site in the fall before planting. If the nematode assay does not indicate the presence of root-knot, root-lesion or ring nematodes, a 6-8 ft strip to be used for the tree row may be fumigated.

Pest(s)	Material(s)	Rate/Acre	Effectiveness	REI/PHI	Suggested pre-plant interval
Ring nematodes Root-knot nematodes Root-lesion nematodes	<i>1,3-dichloropropene</i> Telone II	27-35 gallons	++++	5 days	4 to 8 weeks, longer when dissipation is slow.
<p>REMARKS: Telone II is highly toxic. Carefully abide by all label precautions, and review the label before each application. Telone II may be used when soil temperatures are from 40° to 80°F at the prescribed injection depth (a minimum of 12 inches). Thorough soil preparation is required, and soil moisture is a critical consideration. If it is too dry, the soil surface will not seal enough to prevent premature dissipation. If the soil is too wet, the product is less effective because it will not move as well in the soil. Excessive soil moisture can also prolong desired dissipation from the soil, which forces delay of planting to avoid phytotoxicity.</p> <p>Soil temperatures of 40° to 80°F are required for use of Telone II. However, the product is more active at the upper end of this temperature range. In the Southeast, applications should generally be made in the fall prior to mid-November. October soil temperatures often provide the best opportunity for efficacy.</p> <p>Trees can be easily killed by Telone II if planting takes place too soon after application. At an absolute minimum, adhere to a pre-plant interval of 4 weeks from application to planting for the 27 gallons per acre (gpa) rate and five weeks for the 35 gpa rate. If soils are wet or they have a clay component, dissipation will be much slower. Plan for at least 6-8 weeks between fumigation and planting; even more time may be necessary. Before planting, use a soil probe to check the soil at the full depth of injection; if the odor of Telone II is present, dissipation is not complete and it is too early to plant. Cultivation, at a depth not to exceed the depth of Telone II application, with subsoil shanks, a middle buster or other implements, will hasten dissipation of Telone II. More than one cultivation may be required to get Telone II out of the ground pre-plant.</p>					
Ring nematodes Root-knot nematodes Root-lesion nematodes	<i>metam sodium</i> Vapam, Sectagon II, Busan 1020	75 gallons	+++	48 hours*	<p>*In addition, if tarps are used for the application, non-handler entry is prohibited while tarps are being removed.</p> <p>See label for details. Soil temperature must be 40°-90°F for activity. Soil moisture must be adequate, and soil has to be thoroughly cultivated prior to application.</p> <p>Planting can begin 14-21 days after treatment on well-drained soils which have a light to medium texture and which are not excessively wet or cold following application. If soils are heavy or high in organic matter, or if the soils remain wet and/or cold (<60°F) following the application, a minimum interval of 21 days or greater should be observed. Dissipation can be increased through cultivation. Plan for at least a 4-week interval between treatment and planting. More time may be required.</p>
Bacterial canker	<i>1,3-dichloropropene</i> Telone II	27-35 gallons	++++	5 days	Allow 4 to 8 weeks between application and planting, longer when dissipation is slow.

Pre-plant Crop Rotation Treatment

Crop rotation is used to starve nematodes by growing crops on which they cannot feed or reproduce. Rotating land with wheat for 3 years prior to establishing a peach orchard has been shown to be as effective as pre-plant methyl bromide fumigation in suppressing the ring nematode. In addition to wheat, MaxQ tall fescue prevents two species of root-knot nematodes, *Meloidogyne incognita* and *M. hapla*, from multiplying, while also reducing *M. javanica*. MaxQ has also been shown to suppress root-lesion nematode populations. If ring nematode is present, MaxQ would not be effective. Likewise, if root-knot nematodes are present, wheat rotations would not be effective.

PEACH TREE SHORT LIFE MANAGEMENT

A key management tool in reducing loss from peach tree short life (PTL) is to avoid pruning peach trees between 1 October and 1 February. To complete annual pruning and maintain a labor force within a manageable size, sometimes growers are forced to prune during this period. The following points can be used to select blocks to minimize, but not eliminate, risk of pruning during this period.

1. DO NOT prune any orchard where the ring nematode, *Mesocriconema xenoplax*, is present between 1 October and 1 February.
2. DO NOT prune orchards on Nemaguard rootstock between 1 October and 1 February.
3. DO NOT prune orchards less than 6 years old between 1 October and 1 February.
4. To minimize risk of late fall - early winter pruning, choose blocks on Guardian (BY520-9), Lovell, or Halford rootstocks, free of *M. xenoplax* and over 7 years old for pruning during this period.

The best time to sample for *M. xenoplax* is December - March. This means sample this winter to schedule pruning for next winter. Once *M. xenoplax* is found, however, annual sampling is less necessary, as once it is present it will continue to build up throughout the remaining life of the orchard. When testing a current or future peach site, always indicate the need for speciation of ring and root-lesion nematodes. Use recommended herbicides to manage weeds. Avoid deep disking or cultivating within the orchard to prevent root damage.

Guardian® Rootstock: Guardian rootstock has survived better than other commercial peach rootstocks, including Lovell, on sandy, replant sites infested with ring nematodes (*M. xenoplax*) in the Southeast. Guardian is a vigorous rootstock that is more tolerant of the bacterial canker and/or cold injury that typifies the peach tree short life syndrome. Guardian, like Nemaguard, will sucker and is resistant to most races of *Meloidogyne incognita* and *M. javanica* root-knot nematodes. However, Guardian is susceptible, like other peach rootstocks, to *Meloidogyne floridensis*, to oak root rot (*Desarmillaria tabescens*) and is still being evaluated for long-term orchard performance. Guardian, like Lovell and Nemaguard, is susceptible to *Pratylenchus vulnus* (root-lesion nematode).

ARMILLARIA (OAK) ROOT ROT MANAGEMENT

Armillaria root rot is caused by a root-borne fungus *Desarmillaria tabescens*. It survives in roots left in the soil from previous hosts such as hardwoods, pines, or peach, and infects trees through root-to-root contact. The longer a site has been in peaches, the more likely many infected roots will have accumulated in the soil, which will lead to significant premature peach tree mortality in the new orchard. All commercial peach rootstocks, except for MP-29, are susceptible to the disease. MP-29 is a peach/plum hybrid with still limited availability for commercial producers due to difficulties in producing planting stock. While resistant to Armillaria root rot, MP-29 has only been slightly less tolerant to bacterial canker than Guardian® on severe replant sites and is considered a semi-dwarfing rootstock that will produce a smaller canopy compared to Guardian® rootstock. It also produces some suckers from roots in the tree row that may increase susceptibility to systemic herbicides.

MP-29 Rootstock: MP-29 is a peach/plum hybrid with still limited availability for commercial producers due to difficulties in producing planting stock. While resistant to Armillaria root rot, MP-29 has only been slightly less tolerant to bacterial canker than Guardian® on severe replant sites. MP-29 is a semi-dwarfing rootstock that will produce a smaller canopy (40-60%) of that produced when using a Guardian® rootstock. It also produces some suckers from roots in the tree row that may increase susceptibility to systemic herbicides. MP-29 is resistant to most races of *Meloidogyne incognita* and *M. javanica* root-knot nematodes. It is also resistant to *Meloidogyne floridensis*.

Root-Collar Excavation (RCE): RCE, AKA ‘Berm culture’ is a horticultural method to extend the life of trees on replant sites suffering from Armillaria root rot disease. The planting system takes advantage of the fact that the *D. tabescens* fungus does not grow in root or trunk sections above the soil line. This planting type is only recommended for peach trees with Armillaria root rot susceptible rootstocks planted on replant sites with a history of Armillaria root rot. Trees are planted shallow (roots initiate no more than two inches below the soil line) on 3-ft. wide berms 12”-14” in height and formed preferably with a levee plow that leaves shallow furrows on both sides of the berm. After two years of tree establishment, the soil around the roots is removed either with an air spade or by hand with hoe and shovel. Trees planted by berm culture live on average two years longer but eventually do succumb to the disease. The furrows may cause significant erosion over time and thus it is recommended to level the berm between trees as soon as possible. Some growers report successful leveling of the berm between trees using a disk harrow soon after planting but other technologies are also under development.

VERTEBRATE MANAGEMENT

Vertebrate pests of orchards include deer, rabbits, voles, cotton rats and fruit-feeding birds. In general, deer, vole and rabbit problems are more severe in apple and pear than in peach. However, all of these pests will damage stone fruit. A more detailed discussion of vertebrate pest management in orchards may be found in *Integrated Orchard Management Guide for Commercial Apples in the Southeast* (NCSU Cooperative Extension).

WHITE-TAILED DEER (*Odocoileus virginianus*): Deer most often cause damage on emerging leaves and shoots in spring and summer. Deer pinch their food between their lower incisors and a tough pad in their upper jaw. Feeding damage on leaves creates ragged tears in the tissue that are very damaging to young growth. During September to November, after antler growth is complete, bucks may damage trunks and scaffolds by rubbing their antlers to rub the velvet off their newly acquired antler growth. Deer are creatures of habit. They will not return to a forest diet once they feed on more nutritious plants. While damage from deer browsing is most severe on young trees, significant economic losses can occur in mature orchards.

Deer Management. Consider the severity of deer damage during the previous year and reports of deer density as indicators of potential problems. Compare the cost of control versus the cost of damage. In new plantings, browsing damage may set back development and fruiting for several years. Multiple methods for limiting deer damage should be considered. Anticipate the potential for deer damage and initiate control measures before deer establish a feeding habit. Preventing deer damage before it begins is easier and more successful than trying to stop deer damage after it has begun.

1. **Habitat modification.** Deer prefer early successional forests in the shrub-tree sapling stage. They are also abundant where field crops, orchards and forests are interspersed. Converting forests adjacent to orchards to cropland or pastures may reduce deer damage.
2. **Exclusion.** Fences are an expensive, but effective, form of habitat modification.
3. **Hunting.** Encourage hunting. Non-hunted areas may serve as refuges. Encourage harvest of does.
4. **Shooting.** Check with wildlife officers regarding permission to shoot deer out-of-season. Lethal controls are often temporary in nature.
5. **Repellents.** Repellents work best if damage is light and acreages are modest. **Repellents will not work satisfactorily in high-pressure situations. Area repellents** include tankage (putrefied meat scraps), ammonium soaps, bone tar oil, blood meal, human hair and bar soap. These repellents should be applied close to or on the plants needing protection. In some cases, putting them on the side of the orchard from which the deer enter is effective in keeping deer out of the orchard. However, it may be necessary to disperse repellents throughout the planting. **Contact repellents** work by taste and should be applied directly to plants during the dormant season and on dry days when temperatures are above freezing. Expect some feeding damage when taste repellents are used. Repellents in this category include putrescent egg solids, thiram, and hot pepper sauce. Reapplication is frequently necessary, as rainfall will wash the repellents off.

When using commercial repellents, always follow label directions. Commercial repellents used to repel deer in orchards include:

Bonide Rabbit-Deer Repellent, EPA Registration # 4-136, 11% *thiram*, 11% *acrylic polymers*

Chew-Not, EPA Registration # 358-105, 20% *thiram*

Hinder, EPA Registration # 4-15, 13.8% *ammonium soap* (*application to apple under hot, humid conditions may result in fruit-finish problems such as spray burn rings)

Hot Sauce Animal Repellent, EPA Registration # 72-574, 2.5% *capsaicin*

Plantskydd Repellent, exempt from EPA registration, *dried blood meal*, OMRI listed for organic uses

Rockland Deer Guard, EPA Registration # 4866-10, 37% *egg solids*

Soap bars also have been used in orchards to repel deer. Drill a 1/4-inch hole through the center of small soap bars. Leave the wrapper on to slow weathering. Hang the bars away from the trunk about 30 inches above ground. Bar soap has no EPA registration. The cost of materials plus labor is substantial.

Fencing. In areas with high deer populations, fencing may well be the only viable control method. Electric fences work and are less expensive than conventional fences.

Single strand high-tensile wire fences at 30 inches above ground can be quite effective if they are visible so the deer will “investigate.” Treat the wire with a 50/50 mixture of peanut butter and vegetable oil or drape aluminum foil strips with peanut butter on them over the wire to attract deer. Decorating the wire with flagging will further increase effectiveness. Highly visible fences having very conspicuous wire (wire impregnated tape) are visible to deer and are effective without an attractant. Once deer get shocked from the fence, they tend to avoid the area unless they are being chased.

Pennsylvania five-wire fence may be justified in extreme pressure situations. It is constructed with five high-tensile strength wires that shock deer from wire to wire. **Conventional fencing** may be used to protect individual trees from antler rubbing by setting 3 fence posts 2 feet apart in an equilateral triangle around each tree. Conventional, un electrified fences for deer exclusion need to be at least 8 feet high to be effective. They are much more costly than electric fences.

COTTONTAIL RABBIT (*Sylvilagus floridanus*): Rabbits feed on twigs, buds and bark of fruit trees and other woody plants during winter. Rabbits favor habitats such as thickets, brush piles, fence rows, and the perimeters of cultivated or grassy fields. Rabbit management options include:

Habitat modification. Remove brushy, thick habitats in the vicinity of orchards.

Exclusion. Guards around young trees can prevent rabbits from feeding on the bark of the trunk. Use 1/4-inch mesh hardware cloth. Guards should extend from 2 inches in the soil (for stability) up to 18 to 24 inches above ground. The guard should be big enough that when it is placed around the tree trunk it can be left for several years without girdling. Solid guards that prevent good sunlight or spray contact with the trunk, restrict air circulation around the trunk, or fit closely around the trunk should be put on in late fall and removed in spring to prevent pests from building up under the guard or girdling the trunk.

Fencing. A 3-foot high fence made of small-mesh chicken wire will keep rabbits out. Bury the lower part of the wire a few inches in the ground to prevent rabbits from going under it. Keep weeds and grasses from growing up along the fence.

Repellents. Certain taste repellents are effective in preventing most feeding damage by rabbits when sprayed on tree trunks at the appropriate times or when mixed in with white latex paint being applied to tree trunks for prevention of winter injury to the southwest aspect of trunk. These repellents include:

Bonide Rabbit-Deer Repellent, EPA Registration # 4-136, 11% *thiram*, 11% *acrylic polymers*

Chew-Not, EPA Registration # 358-105, 20% *thiram*

Hinder, EPA Registration # 4-15, 13.8% *ammonium soap* (* application to apple under hot, humid conditions may result in fruit-finish problems such as spray burn rings)

Hot Sauce Animal Repellent, EPA Registration # 72-574, 2.5% *capsaicin*

Plantskydd Repellent, exempt from EPA registration, *dried blood meal*

Rockland Deer Guard, EPA Registration # 4866-10, 37% *egg solids*

VOLES

Pine Vole (*Microtus pinetorum*)

Meadow Vole (*Microtus pennsylvanicus*)

Prairie Vole (*Microtus ochrogaster*)

Voles are compact rodents with stocky bodies, short legs and short tails, small eyes, ears that are partially hidden and dense underfur covered with thicker, longer guard hairs. Voles are usually brown or gray, but many color variations exist. Southeastern orchardists need to be concerned with pine voles, meadow voles and prairie voles. Outlined below is the geographic area in which each of these animals may be found.

Pine Vole¹: Central Texas to Wisconsin & east to the Atlantic coast

Meadow Vole¹: NC, SC, northern GA & TN (northeastern part)

Prairie Vole²: AL (northern third), TN (all except extreme east TN), MO, AR

¹Johnson, M.L. and S. Johnson. 1982. Voles. Pages 326-354 in *Wild Mammals of North America: Biology, Management and Economics*. J.A. Chapman and G.A. Feldhammer, Eds. The John Hopkins University Press, Baltimore, MD.

²Schwartz, C.W. and E.R. Schwartz. 1981. *The Wild Mammals of Missouri*, rev. ed. Univ. of Missouri Press, Columbia. 356 pp.

Monitoring to determine if voles/cotton rats are present in the orchard and what species are there is important, because controls differ with species.

Pine voles average 4 to 6 inches in length (including the tail, which is about the same length as the hind foot). Their brown fur is soft and dense. Some underparts are gray with some yellow to cinnamon. The tail is barely bicolored or unicolored. They have small, indistinct eyes as compared to the meadow vole.

Meadow voles average 5 1/2 to 7 1/2 inches total length (including the tail, which is about twice the length of the hind foot). They have gray to yellow-brown fur obscured by black-tipped hairs. Their underparts are gray (sometimes washed with silver or buff). The tail is bicolored.

Prairie voles average 5 to 7 inches in total length from the nose to the tip of the tail, which is about twice as long as their hind foot. Their fur is gray to dark brown and mixed with gray, yellow, or hazel tipped hairs, giving it a peppery appearance. The underparts are gray to yellow-gray.

Habitat

Voles prefer areas having a heavy ground cover of grasses, grasslike plants or litter. When two species are found together in an area, they usually occupy different habitats. Orchards, windbreaks, overgrown fencerows and ditchbanks and cultivated fields (especially no-till fields) are favorable habitats. In addition to these, the different types of voles have some other habitat preferences. **Pine voles** may be found in deciduous and pine forests, abandoned fields, shrubby areas, orchards and other areas having heavy ground cover. They are particularly prevalent where the soil texture permits easy tunneling. **Meadow voles** prefer wet meadows and grassland habitats, particularly unmowed or infrequently mowed tall fescue fields. **Prairie voles** may be found in old fields and marshlands.

Population Development and Fluctuations

Voles may breed throughout the year when winters are mild, although the peak breeding period is between March and October. They have one to five litters per year with an average of three to six young per litter. Gestation takes about 21 days. Young are weaned at 21-days old. Females mature in 35 to 40 days. A single female could potentially produce in excess of 70 young in a year. The average lifespan of a vole is in the range of 2 to 16 months. Large population fluctuations are common. Population levels generally peak every two to five years, but the cycles are not predictable. Dispersal, food quality and quantity, climate, predation, physiological stress and genetics have all been shown to affect population levels. Other factors are also probably involved.

Behavior

Voles are active day and night throughout the year. Home range is 1/4 acre or less. Voles construct tunnels or surface runways. A single burrow system may contain several adults and young. **Meadow voles** and **prairie voles** build 1- to 2-inch-wide surface runways in grass and litter. Vegetation near well-traveled runways may be clipped close to the ground. Feces and small pieces of vegetation will be found in the runways. Nests built of dry grasses and leaves are large, globular and may be found close to tree trunks in clumps of grass. **Pine voles** do not use surface runways. They construct extensive subterranean tunnels in loose, crumbly soil. As they tunnel, they push out dirt, producing small, conical piles of soil on the surface of the ground.

Damage and Damage Identification

Meadow voles and prairie voles may cause extensive damage by feeding on and girdling the base of trunks or roots at or near the soil line. This damage is most apt to occur in late fall and winter when more preferred food sources of grasses, tubers and seeds are limited. Snow cover often encourages severe injury. **Pine voles cause damage beneath the surface of the soil, generally to a depth of about 6 inches.** Frequently, injury to trees is not evident until trees are in decline, often past the point of salvation. Wounds created by voles may serve as entry points for insects/diseases. Voles make non-uniform gnawing marks that occur at various angles and in irregular patches. These marks will be about 1/8 inch wide, 3/8 inch long and 1/16 inch deep.

Damage Prevention and Control Methods

Several different concepts may be used in preventing vole damage. A combination of several methods will provide the best protection. Voles are prey for many predators, including coyotes, snakes, owls, hawks, weasels, dogs and cats, but predators do not normally provide adequate control of vole populations. Predation can be enhanced by not discouraging the presence of predators and by following some of the practices outlined below. Consult with your Extension wildlife specialist about the utility of nest boxes and/or perches for owls and hawks.

Exclusion. Tree guards of 1/4-inch mesh hardware cloth make the most desirable tree guard. Guards should be installed at planting and left in place for several years, since the first five years of tree life is when most damage is apt to occur. Guards should extend from about 2 inches below ground (for stability and to exclude meadow voles and prairie voles) to about 18 to 24 inches above ground.

Guards are not effective deterrents for pine voles, as they feed primarily underground. The cost of guards is substantial. However, compared to the potential loss from damage, they can be a good investment.

Cultural practices and habitat modification in and around the orchard may reduce vole populations. Voles' preferred food sources are roots and stems of grasses and other ground cover. Elimination of weeds and litter under and around trees will reduce vole numbers. Maintain a 6-foot herbicide strip and keep the middles and orchard borders mowed close to lower vole numbers. Clearing up and mowing adjacent ditchbanks and grassy waterways also discourages voles.

RODENTICIDES MAY BE NEEDED TO SUPPLEMENT NONCHEMICAL CONTROL. TOXICANTS SHOULD NOT BE CONSIDERED AS A STAND-ALONE METHOD OF VOLE CONTROL. THE FOLLOWING MATERIALS ARE LABELED FOR USE IN SOUTHEASTERN STATES.	
zinc phosphides—ZP rodent Bait Ag, Ridall-zinc, Prozap® Zinc Phosphide Pellets	Zinc phosphide 2% bait should only be used during the dormant season. Zinc phosphide is an acute dosage rodenticide. When used, it presents a serious nontarget risk – including to the applicator. It is highly toxic to all birds and mammals. It may be applied in any of the following ways: <ol style="list-style-type: none"> 1) Broadcast - Apply at a rate of 10 pounds per acre using mechanical spreaders into vegetative cover to reduce the potential for non-target poisoning and to focus on areas in which voles are found. 2) Spot or trail baiting - Place one teaspoon of pellets in surface trails or at the mouths of holes leading to underground burrows. Two to four bait spots should be made near the base of each infested tree. Do not disturb the runway system and cover pellets by pulling overhanging grass back in place. Use two to three pounds of bait per acre. 3) Bait placement stations - Place 2 1/2 ounces of bait under at least two established stations per tree. These stations should be established two to three months prior to the baiting period by placing rectangular (at least 15 inches by 15 inches) asphalt shingles, etc. at the tree dripline. Car tires split horizontally and placed with the hollow side down provide a good place to set the bait.
diphacinone—Ramik Brown Note: Only labeled for use in the following southeastern states – Georgia, North Carolina, South Carolina, and Virginia	Anticoagulant rodenticides pose less of a risk to nontarget species (including the applicator) than zinc phosphide, making them the preferred choice in states where they are labeled for use. Ramik Brown is a 0.005% bait for hand placement in vole runs at 10 pounds per acre or for broadcast in vegetation under and around trees at 20 pounds per acre. Ramik Brown is a continuous feed anticoagulant and will need to be reapplied after 21 to 30 days to ensure that voles in the nest at the first treatment are exposed.

Vole Monitoring

Vole control decisions are a trade-off between the cost of control and the cost of damage. Most damage occurs with high populations. Monitoring determines when populations start to increase and when it is time to use rodenticides. Fall is the best time to check for voles. The presence of runways free of growing vegetation, bits of freshly cut vegetation and brown or green droppings shaped like rice grains are signs of surface-feeding voles. Since pine voles do not use surface runways, they are harder to detect. Look for mounds of loose soil at push-up holes. Also, look for tiny, elongated tooth marks on fruit lying on the ground as evidence of vole presence.

Bait placement stations (concentration stations) put down two to three months prior to baiting may be checked for the presence of tunnels. Bait may be seeded directly into the tunnels and the station replaced. Check to see if the bait has been consumed after two weeks. If the bait is gone, assume that you still have an active population in that area and put down additional bait. If some bait remains, assume that voles using those tunnels have been controlled and do not use additional bait under that station.

The apple sign test is a good indicator of vole activity. Select 40 to 50 scattered trees, but especially near the edges and other prime habitat. Check for the presence of holes and runs. Place a piece of asphalt roofing over a hole or run. After one week, check the shingle and place a piece of apple about the size of a quarter in the run or hole under the shingle. Check the next day and record whether the apple is missing, which is a positive sign for voles. Keep records on all of the selected trees and use these same trees for a full year. It is not usually necessary to know the exact number of voles present, but it is good to know if the population is increasing or decreasing and whether a given treatment has had an effect on population size. To obtain an estimate of vole population, weigh the apple piece at the time it is put out and again 24 hours later. One pine vole consumes approximately 13 grams of apple in a 24-hour period. One meadow vole will consume about 20 grams of apple in this same time period. This is also an effective way to check the results of a rodenticide application.

Trapping is not an effective means of controlling large vole populations, but can be used to check for their presence and to aid in identifying the type of voles in the orchard. Mouse traps with expanded triggers may be placed perpendicular to runways, at the level of the runway, and set without bait. This will prevent non-target animals that might be attracted to bait from being caught. Voles should be easiest to trap from fall through late winter. Select about 10 trees and place four traps per tree. Record the number of voles caught over a 3- to 5-day period. If the control program is successful, no more than two or three voles should be caught. For surface-feeding voles, place traps in runways perpendicular to the direction of travel, even with the bottom of the runway and with the trigger in the runway. For pine voles, excavate a portion of a tunnel and set the trap perpendicular to the direction of travel and even with the bottom of the tunnel. Be sure to provide enough room for the trap to function properly. Cover the trap with something like a pot or bucket that will prevent light from reaching the trap yet not interfere with its operation. Set traps in the afternoon and check them the following morning to lessen chances of other animals robbing or getting caught in the traps.

Tips to Increase the Effectiveness of Rodenticides

1. Apply baits only in late fall and winter.
2. Do not apply baits to bare ground. Maintain a clean area extending out from tree trunks at least three feet.
3. Apply baits during a period when no rain is expected for the following three days, as wet weather may decrease the effectiveness of the bait.
4. Have rodenticides applied by mid-afternoon, as voles may be most active at dawn and at dusk.
5. Monitor to determine the types of voles present and to evaluate the effectiveness of the control program. This will allow for correct bait placement and for repeat bait applications if needed.
6. If more than one type of rodenticide is labeled for use in your state, rotate usage of types during a given season, as voles will develop "bait shyness" to it and as it is a very toxic material.
7. Consider the use of rodenticides as only one part of a vole management program. Depending only on rodenticides will result in poor control.

Voles probably account for more fruit tree decline and death than any other factor in U. S. orchards. Frequently, by the time vole damage is noticed, it is too late to save the trees. Even where damage has not led to tree death, several years may pass with reduced yields and quality before damaged trees completely recover. Vole control should be considered as a preventative program and should be an integral part of orchard management programs.

BIRD CONTROL IN TREE FRUITS

All birds except pigeons, house sparrows and starlings are protected by state and/or federal laws, making it illegal to kill them without a special permit. Be sure to contact your state wildlife agency prior to using any lethal, or potentially lethal, bird control practices.

Several types of birds, including crows, robins, common grackles, starlings and several songbirds, can cause significant damage to fruit crops. Crows are perhaps the most troublesome in tree fruits. They damage fruit by pecking holes in it, thus destroying the marketability of the fruit and creating an entry point for rots and insects.

Isolated orchards tend to receive more bird damage than those in close proximity to other orchards. Smaller blocks of fruit frequently experience more bird damage than do larger blocks. Trees or power lines near orchards can serve as perches for birds. Nearby woodlands or brushy fields may be used as nesting areas and roosting sites. High numbers of birds near orchards often results in increased damage from birds. Losses to birds are often high on early ripening varieties and decline as the season progresses.

Bird control options are not as great for tree fruits as they are for small fruits. The economic cost of establishing controls may not be justified when compared to the actual damage caused. If control measures are warranted, consider the following options:

Exclusion involves the use of netting, so it is not a feasible control option except when only a few trees and/or small trees are involved. The netting should cover the entire canopy of the tree and go to the ground on all sides. With careful handling and storage, nets should last for several years.

Auditory scare devices repel birds by scaring and disorienting them. Birds tend to adjust to the presence of such devices very quickly. Distress or alarm calls are more effective, however, these calls are species specific, so it is important to know what types of birds are causing the problems and to use calls that are developed for them. Regardless of the type of sound devices used, they will work better if the sound occurs at irregular intervals and from different areas within the planting. Check for local ordinances that might affect the use of such devices.

Visual scare devices such as streamers, spinners, aluminum pie pans, plastic owl and snake models and scare-eyes may work for a little while, however, birds will quickly adapt to their presence. These items are more effective when they are changed regularly so birds do not learn that they are harmless. Combining them with auditory devices will further increase their effectiveness. Reinforcing the perception of danger by occasional shooting when and where permitted will be of benefit.

Lasers – Not enough scientifically valid research has been done on the use of lasers for bird control in fruit crops to merit recommendations at this time. As with other methods, lasers appear to work best when they are used beginning before birds establish feeding patterns, operated from before sunrise until just past sunset, and when both the pattern and frequency of discharge are changed often. Using other control techniques in conjunction with lasers will provide better results than either used alone.

Chemical repellents may be effective in decreasing losses from birds, however, their cost may be prohibitive except in special situations. Methyl anthranilate is labeled for use as a taste repellent for bird control. As with most repellents, rain will decrease its effectiveness to the point that reapplication is needed.

Summary of bird management – A bird control program should be started before birds establish a feeding pattern. If scare devices are to be effective, they need to be started before sunrise and be continued until sunset. Auditory and visual devices should be moved frequently and supplemented with shooting where legal and practical. Combining several methods is usually more effective than relying on just one. Check local laws regarding the use of some devices and techniques before employing them.

EFFECT OF pH ON PESTICIDE ACTIVITY

The pH of spray water can affect the activity of some pesticides. When Imidan, Guthion, and other select materials are exposed to elevated pH above 7.5, they undergo hydrolysis and break down. Rate of breakdown is influenced by solubility and temperature. For example, captan is hydrolyzed very quickly at alkaline pHs, but because it is very insoluble, the impact of pH is negligible unless the captan is allowed to stand for a week or more. The same is true for chlorothalonil. Hydrolysis increases with rising water temperature. If the time in the spray tank is limited by applying pesticides immediately, the amount broken down is limited.

The water source can be a factor. Although most wells, streams and rivers in the Southeast are mildly acidic (6.7 + or - 0.2), there are exceptions; therefore, their pH should be checked a few times before regular use. A more likely occurrence of alkalinity is from ponds, especially those high in algae and other organisms. These ponds undergo diurnal pH changes as a result of dissolved carbon dioxide. pH levels > 10 have been observed. Alkalinity contributed by CO₂ is weakly buffered and readily changed by acidifying agents.

EFFECT OF SPRAY WATER pH ON PEACH PESTICIDES

Wettable powder, emulsifiable concentrate, flowable, and other common pesticide formulations are diluted in water before application. Several common peach pesticides are subject to varying degrees of chemical breakdown in water. Acidity or alkalinity of water can be measured with pH test paper or a pH meter. pH is a measure of hydrogen (H⁺) and hydroxide (OH⁻) ion concentration in water. A logarithmic scale of 0 to 14 is used to express pH values. A pH of 7 indicates neutrality; values below 7 are acidic while those above 7 are alkaline. Alkaline hydrolysis, chemical breakdown of pesticides in basic or alkaline solutions (pH > 7) is not uncommon. Because a logarithmic scale is used to represent pH values, a pH of 6 is 10 times more acidic than a pH of 7, and a pH of 5 is 100 times more acidic than a neutral pH of 7. The following table is a compilation of commonly used peach pesticides and their responses to pH. Spray tank pHs that are not suitable may be adjusted by addition of agents that either make solutions more acidic or more alkaline. Some pesticides should not be acidified under any circumstance; their labels will contain specific water quality statements. Information on the pH of spray water was gleaned from University of Missouri, Utah State University, and the British Columbia Ministry of Agriculture web sites.

RESPONSE OF COMMON PEACH PESTICIDES TO pH						
Active ingredient	Trade Names	Optimal pH	pH 6.0	pH 7.0	pH 8.0	pH 9.0
imidacloprid	Nuprid	7.5	> 31 days			
formetanate hydrochloride	Carzol	5.0			4 hours above pH 7	
pyridaben	Nexter	stable from pH 4 to 9				
phosmet	Imidan	5.0		12 hours	4 hours	
carbaryl	Sevin	5.0		24 days	2.5 days	1 day
spinosad	SpinTor	stable from pH 5 to 9				
paraquat	Gramoxone Extra			not stable above pH 7		
2,4-D amine	Orchard Master	stable between pHs 4.5 to 7				
simazine	Princep					24 days
fluazifop	Fusilade			147 days		17 days
sethoxydim	Poast	7	stable from pH 4 to 10			
captan	Captan			8 hours	10 minutes	
chlorothalonil	Bravo, Equus	7	stable over a wide range of pHs			

SPRAYER CALIBRATION

Sprayer calibration is very important. Sprayers should be calibrated often to guard against using excess pesticides due to nozzle wear, speed increases, etc. Failing to calibrate often costs money, may cause crop damage, and is unsafe and may result in illegal applications, lawsuits, and damage awards.

Broadcast Herbicide Sprayer Calibration

The following procedure will give the gallons (total volume) of material applied per acre on a broadcast basis. **Calibrate with clean water only.** The uniformity of nozzles across the boom should be checked. Collect from each nozzle for a known time period. Each nozzle should be within 5% of the average. Replace nozzles with output above 5% with new nozzles and recheck output. Nozzles with output greater than 5% below the average may simply require cleaning but must be rechecked to ensure proper output.

1. Determine appropriate calibration distance from table. Measure and adjust nozzles to an even spacing. Find spacing in table and read the corresponding calibration distance. Example: For a 19-inch spacing, the distance would be 214.9 feet.
2. Measure and mark calibration distance in a typical portion of the field to be sprayed.
3. Traveling at the desired operating speed, determine the number of seconds it takes to travel the calibration distance. Travel at full operating speed the full length of the calibration distance. Note RPM and gear setting.
4. With sprayer sitting still and operating at same throttle setting or engine RPM as used in step 3, adjust pressure to desired setting.
5. Collect spray from one nozzle for the number of seconds required to travel the calibration distance.
6. Measure the amount of liquid collected in fluid ounces. **Number of ounces collected is the gallons per acre.** For example, if you collect 18 ounces, the sprayer will apply 18 gallons per acre on a broadcast coverage basis. Adjust applicator speed, pressure, nozzle size, etc. to obtain recommended rate.
7. To determine the amount of pesticide to put into a sprayer or applicator tank, divide the total number of gallons of mixture to be made (tank capacity for a full tank) by the gallons per acre rate from Step 6 and use recommended amount of pesticide for this number of acres.
8. Sprayers should be checked for proper calibration every 4-8 hours of use. Simply repeat steps 5 and 6. If there is a difference of more than 5% of original calibration, check the system.

CALIBRATION DISTANCES TO BE USED BASED ON NOZZLE SPACING	
Nozzle Spacing (Inches)	Calibration Distance (Feet)
40	102.1
36	113.4
32	127.6
28	145.8
24	170.2
20	204.2
18	226.9
16	255.2
14	291.7
12	340.3
10	408.4
8	510.5

To determine distance for spacing, divide the spacing expressed in feet into 340.3, example: for a 13" band, the calibration distance would be $340.3/(13/12) = 314.1$.

Air Blast Sprayer Calibration

Check actual sprayer output. Fill sprayer with water. Operating in an orchard at standard gear and RPM determine the time period required to empty the tank and the number of trees sprayed per tank. Convert to gallons per minute. Use planted tree count to determine acreage sprayed per tank and convert to gallons per acre. If a material with considerably different flow characteristics than water is to be sprayed, fill the sprayer with this material.

Sprayer output, gallons per acre, may be adjusted by changing spray tips or adjustments to speed or pressure. **Changing tips should be the primary adjustment.** Turn upper nozzles off to adjust volume for smaller trees.

Speed—Change in gallons per acre (gpa) applied is inversely proportional to the change in speed. If the speed is doubled, the gallons per acre will be halved. If the speed is cut in half, the gallons per acre will be doubled. Thus, if nozzles have been installed and pressure set to provide a gpa rate at a certain speed, the sprayer should apply the gpa rate at that speed. The following tables can be used to determine speed of travel.

SECONDS REQUIRED TO TRAVEL 300 FEET AT SELECTED SPEEDS	
Speed (mph) / Time Per 300 Feet (seconds)	
1.5 / 136	
2 / 102	
2.5 / 82	
3 / 68	
3.5 / 58	
4 / 51	
4.5 / 45	
5 / 41	

Measure and mark a distance of 300 feet in the orchard or an area that is similar to the orchard (plowed, fallowed ground, sod, etc.). Find the desired speed in miles per hour (MPH) in the speed column of the table and read the number of seconds required to travel 300 feet on the same line in the seconds per 300 feet column. For example, at 3 mph, the number of seconds required to travel 300 feet is 68. Adjust the throttle and/or other speed control mechanisms until 300 feet is traveled in 68 seconds.

DISTANCE TRAVELED PER MINUTE AT VARIOUS SPEEDS	
Speed (mph) / Distance Traveled Per Minute (feet)	
1.5 / 132	
2 / 176	
2.25 / 198	
2.5 / 220	
2.75 / 242	
3 / 264	
3.25 / 286	
3.5 / 308	
3.75 / 330	
4.0 / 352	
4.25 / 374	
4.5 / 396	
4.75 / 418	
5 / 440	

ALTERNATE ROW MIDDLE SPRAYING

Alternate-row-middle (ARM) spray application is an air-blast application technique that involves direct application of spray to every-other-row middle. Direct spray is applied to the adjoining row middles on the next spray. Each ARM directs spray to half of each tree row, often this is referred to as a half-spray. ARM spraying can be quite useful. Clearly ARM provides less thorough spray coverage than complete (COM) sprays to both sides of each tree row. ARM allows rapid IPM response by halving the time needed to spray. This can be valuable when pest events begin or in adjusting to rains. ARM is especially useful in mid-season when plum curculio and scab pressures are low. ARM is not a good choice for scale control or pre-harvest sprays.

PEST MANAGEMENT PROGRAM FOR NON-BEARING TREES

Practice	To Control	Pesticide	Rate/Acre	REI/PHI	Remarks
At planting-- Dip trees	Leaf curl	Ferbam Granuflo	2 lb/100 gal	24 hr/21 days	Agitate tank just before dipping trees. Immerse bundles of nursery trees (include all buds) for 3 minutes before setting trees in orchard. If trees are not planted immediately, allow them to dry before returning to storage.
Delayed dormant	Leaf curl Mites & Scale	Ferbam Granuflo	4.5 lb	24 hr/21 days	If orchards were not sprayed the previous season, apply Ferbam between 95% leaf drop and bud swell. Mix Ferbam in half-filled tank, then fill, adding oil last OR add Ferbam after oil is diluted in spray tank. Other options for leaf curl include Bravo and copper compounds (consult labels). Apply no more than 1.5 gal oil per acre, no later than first bud break. Thorough coverage, to near the point of run-off, enhances control.
		dormant oil plus	1.5 gal	12 hr/not recommended after bloom	
April or May	Scab Borers Scale Oriental fruit moth Shothole borers	sulfur 80% plus Diazinon	9-12 lb 1 pt	24 hr/0 days 4 days/non-bearing	
		or Asana XL	5.8 fl oz	12 hr/non-bearing	
July or August	Borers	Asana XL	5.8 fl oz	12 hr/non-bearing	Apply Asana XL from early August to late September with a handgun, effectively drenching young trees, especially the lower trunk.
	Scale	Horticulture oil	1 to 1.5% by volume	12 hr/ non-bearing	Apply dilute, at least 125 gal per acre. Do not apply when fruit is present or daytime temperatures reach the high 90's. Do not apply within 2 weeks of applying sulfur, captan or Sevin.

GIRDLING

Response	Method	Timing	Remarks
Advance and concentrate maturity, increase size in early season varieties	In irrigated orchards, girdle scaffold limbs completely with 1/8" or 3/16" knife. In non-irrigated orchards, make an "S" girdle cut (1/2" vertical gap between cut ends).	Final 7-10 days before complete pit hardening, approximately 40 days after full bloom	Girdle only healthy trees at least 4 years old. DO NOT girdle trees under moisture stress. Girdled trees should receive complete, not ARM, sprays to improve coverage, as girdling wounds make trees more attractive to lesser peachtree borer.

ANNUAL FERTILIZATION OF BEARING TREES

Fertilizer rates should be based on soil and leaf analysis, irrigation practices, variety, and visual indicators such as fruit yield and quality, leaf color and terminal shoot growth. In established orchards, the primary value of soil testing is to monitor soil pH levels since this will impact nutrient availability to trees. In addition, the correlation between soil test results and the actual nutrient content of the plant can be poor and is, therefore, not a reliable indicator of the tree's needs.

NITROGEN – It is estimated that between 60 and 70 pounds of actual nitrogen are removed in the crop each year. In most peach orchards, nitrogen should be applied annually. The actual amount of nitrogen to be applied should be based on terminal shoot growth, tissue analysis, and soil analysis. Split applications of nitrogen may result in increased fruit quality and a lessening of tree vigor. In bearing orchards (3 years-old or older), the first application should be made after harvest in mid- to late-August. The second application should be made in spring at bloom to petal fall (all growth of the tree for the first 30 days following bud break comes from stored reserves in the tree). Tree roots are unable to pick up fertilizers from the soil prior to this time.

Postharvest fertilization:

Adjust rates based on the following measures of terminal growth:

- between 12 and 18 inches of terminal growth - apply 30 pounds of N per acre
- less than 12 inches of terminal growth and showing a pale color in foliage – apply 35 pounds of actual nitrogen per acre
- over 18 inches of terminal growth – do not apply any post-harvest nitrogen

Spring (bloom to petal fall) fertilization:

Fertilizing at this time will allow varying nitrogen rates based on crop load. A base rate of 30 to 35 pounds of actual nitrogen per acre should be modified as-needed.

Fertilizer should be broadcast to the weed-free area under trees.

If nitrogen is applied through the irrigation system, rates may be reduced by up to 40 percent of broadcast rates with equal results.

FOLIAR ELEMENT SUFFICIENCY RANGES FROM JULY AND AUGUST FOR PEACHES AND NECTARINES IN GEORGIA (based on values for mid-shoot leaves)									
Element %					Element (ppm)				
N	P*	K	Ca	Mg	Fe	Mn**	Zn*	Cu	B***
2.75 - 3.5	0.12 - 0.5	1.50 - 2.5	1.25 - 2.5	0.25 - 0.5	60 - 400	20 - 150	15 - 50	5 - 20	20 - 45
* If P is high, Zn may be deficient at 18 ppm. ** When Mn exceeds 150 ppm, it is a good indication of low soil pH. *** Boron levels greater than 50 ppm may be toxic.									

YOUNG TREE ESTABLISHMENT (NON-BEARING)		
	Year 1	Year 2
30 days after planting	Broadcast 0.1 pound of actual nitrogen per tree over a 4-5' diameter circle.	Broadcast 0.2 pound of actual nitrogen per tree over a 6' diameter circle.
May*	Broadcast 1 lb of calcium nitrate over a 6' diameter circle.	Broadcast 1.25 lb of calcium nitrate over a 6' diameter circle.
July*	Broadcast 1 lb of calcium nitrate over a 6' diameter circle. Do not apply after 1 Aug. Late application may make young trees more prone to cold damage.	Broadcast 1.25 lb of calcium nitrate over a 6' diameter circle. Do not apply after 1 Aug. Late application may make young trees more prone to cold damage.

*Actual amount of nitrogen to be applied during May and June should depend on tree growth and the presence of timely irrigation

Pesticide Precautions

1. Follow all directions, restrictions, and precautions on pesticide labels. It is dangerous, illegal, and wasteful to do otherwise.
2. Keep your pesticides secure! Store all pesticides in original containers with labels intact and behind locked doors. Keep pesticides out of the reach of children.
3. Use pesticides at correct label rate and application intervals to avoid illegal residues or injury to plants and animals.
4. Do not allow pesticides to drift or to contaminate water.
5. Properly dispose of surplus pesticides and cleaned empty containers as soon as possible.
6. Follow all directions on the pesticide label exactly.
7. Do not take any action that may threaten an Endangered Species or its habitat. Your county extension agent can inform you of Endangered Species in your area, help you identify them and, through the Fish and Wildlife Service Field Office, identify actions that may threaten Endangered Species or their habitat. Follow pesticide label and EPA's Endangered Species county bulletin information for pesticide applications.

Trade names are used only for information. The Cooperative Extension Service, the University of Georgia College of Agricultural and Environmental Sciences, does not guarantee or warrant published standards on any product mentioned; neither does the use of a trade or brand name imply approval of any product to the exclusion of others that may also be suitable.

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