

# 2009 SOUTHEASTERN PEACH, NECTARINE AND PLUM PEST MANAGEMENT AND CULTURE GUIDE

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## 2009 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. Rates for fungicides or insecticides are expressed as the rate per acre for moderate to severe disease and insect pressure. The volume of water used should not affect the amount of chemical used per acre. A minimum of 60 gallons/acre of final spray mixture is recommended to provide adequate coverage of the tree. For control of scale insects, use at least 125 gallons per acre and slow tractor speed to 2-3 mph. Substandard coverage often leads to unsatisfactory control.

This guide is to be used only by commercial growers. Observe all label precautions and recommendations. Brand names of pesticides are given in the spray schedule as a convenience to the grower. They are neither an endorsement of the product nor a suggestion that other products with the same active ingredient are not effective. Effectiveness ratings in the following tables range from +, slightly effective, to +++++, highly effective. However, many factors, such as time of application, spray coverage and rates, influence the level of pest control achieved.

Pesticide resistance, pest populations developing tolerance to previously effective pesticides, is a major concern. Repetitive use of the same, or related, pesticides, those which share the same toxic mode of action (MOA), should be avoided because this use pattern encourages resistance development. The Insecticide Resistance Management Committee (IRAC), Fungicide Resistance Management Committee (FRAC) and Herbicide Resistance Action Committee (HRAC) groups having the same, or similar, toxic modes of action. **Growers are encouraged to practice resistance management by alternating MOAs. Alternating MOAs, that is switching to materials with dissimilar toxins, can be accomplished by alternating materials which have unlike IRAC, FRAC and HRAC numbers. This practice should minimize, or slow, the development of resistance.**

### DORMANT—AFTER LEAVES HAVE FALLEN BUT BEFORE BUD SWELL

**BACTERIAL SPOT** may be quite damaging. In many Southeastern production areas, virtually all varieties would benefit in most years from a program of late-dormant, petal fall and shuck-split applications. **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 improve control. **Susceptible cultivars, such as O’Henry, Elegant Lady, Sunbrite, 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. Monitoring current weather trends and 30-day forecasts typically improves decisions.**

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 delayed dormant (1 to 5% bud swell). The need for subsequent applications and the interval between applications after delayed dormant depend on the frequency of rainfall, high humidity and heavy dew. When rainfall occurs at least weekly, additional sprays should be applied. However, use caution as multiple applications of copper during periods without rainfall may result in excess copper accumulation on the tree and potentially greater than expected phytotoxicity when moisture occurs. Rate of elemental copper (metallic copper equivalent, MCE) can vary with formulation.

Bacterial spot (*Xanthomonas arboricola* pv. *pruni*) is sensitive to copper. Copper’s bactericidal activity comes from its ability to exist in what is termed the “free” or “ionic” state. In nature, copper almost always is combined with other elements or minerals. Ionic copper is very reactive. The reactive, ionic state that kills bacteria, however, is also responsible for phytotoxicity. The amount of ionic copper is greatly influenced by pH of copper-containing droplets of water on the leaf. More acidic (pH below 7.0) solutions have more free copper, making them more bactericidal, but also more phytotoxic. In contrast, the more basic (pH greater than 7.0) solutions have less free 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 materials on peaches. **Peaches can be very sensitive to copper, and if improperly used, coppers can cause serious phytotoxicity. Always use the correct rate of copper, and be sure sprayers are correctly calibrated.** Phytotoxicity is more likely to occur when conditions are slow drying (more than 20 minutes) and cool (less than 55°F). Injury is usually to leaves, in the form of reddish-yellow discoloration, shot-holing and defoliation. **When copper sprays have been used previously, always inspect the trees for copper injury and whether an additional copper application may cause unacceptable injury.** The rate of copper may need to be reduced or oxytetracycline used instead.

There are numerous copper-containing fungicide/bactericide products and formulations. The amount of “metallic (elemental) copper equivalent (MCE)” which is the potential active ingredient (a.i.) of these products ranges from slightly more than 5% to greater than 50%. Thus, the amount of formulated product recommended per acre may vary greatly. To standardize, recommendations are based on the amount of metallic, or elemental, copper equivalent (MCE) per acre when applied using 75 to 125 gal water per acre. The MCE approach works well for most copper formulations, though less so for the “liquid-type” formulations such as Copper-Count-N and Tenn-Cop 5E, which contain less than 10% metallic copper. 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 compared to the amount required by a different or older formulation. Some copper formulation may be tank-mixed with superior oil when application (e.g., dormant) takes place before bud break.

**Calculations for the amount of elemental copper per unit (lb or gal) of formulated product:** For dry copper formulations, to calculate the amount of metallic (elemental) copper per unit (lbs) of formulated product, use the % metallic copper equivalent (MCE) listed on the product label. Convert the % to decimal (example: MCE is 30% = 0.30). This means there is 0.30 lbs of elemental copper in each 1.0 lb of formulated product. For liquid (e.g., flowable) copper formulations, the product label may list the amount (lbs) of copper per gallon. For example: if MCE is 4.0 lbs per gal, thus for a recommendation to use 1.0 lb of elemental copper (MCE), use 0.25 gallon (1.0 qt) of formulated product.

**DORMANT (continued)**

Formulations such as Cuprofix Ultra 40 Disperss, Kocide 101, Kocide 2000, Kocide DF and Kocide 3000 have been tested at one or more locations in the southeast for many years. Other formulations may perform as well, but have not been tested. Rates per acre are calculated to the nearest 0.01 lb then rounded to the nearest 0.1 lb or fluid ounce (fl oz). A variation of approximately 10% in rate/A should not significantly affect the activity, but do NOT EXCEED label rates. Although most copper formulations have a re-entry time-interval of 24 hours, some copper hydroxide formulations have additional 7-day restrictions particularly for eye-wash – SEE LABEL for details.

Copper is protective and not curative; to be effective, copper materials must be present prior to occurrence of conditions for infection (i.e., the presence of moisture such as rainfall or dew). This also means that good spray coverage of the tree is essential. More aggressive bacterial spot programs should be used on highly susceptible varieties or in orchards where bacterial spot has been damaging or when weather conditions are very favorable for disease.

**BROWN ROT**—Orchard sanitation should be part of dormant tree training. Removal of brown rot mummies, pruning out dead wood, and thorough flail mowing or removal and burning of pruning debris will lower disease inoculum. It is important to flail mow brown rot mummies. Do not just knock them to the ground.

**LEAF CURL**—Leaf curl pressure varies with production area. Some production areas have light leaf curl pressure. History of infection and cultivar susceptibility should be considered when planning control measures. Apply leaf curl fungicides prior to bud swell for optimal control.

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Bacterial spot & leaf curl	<i>Coppers</i> <i>FRAC code M1</i> (% metallic copper equivalent=MCE)		Bacterial Spot +++ Leaf Curl +++	phytotoxicity concerns restrict copper uses to the recommended rates & phenologies	<b>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.</b>  Late dormant applications of copper are recommended, as these applications reduce bacterial populations just ahead of bloom. Use copper products in blocks susceptible to bacterial spot and leaf curl. Use 1.0-3.0 lbs MCE per acre applied in 75-125 gal water/acre.
	<i>basic copper sulfate</i> Cuprofix Ultra 40 Disperss (40% MCE)	5.0-7.0 lbs		12 hr/	Copper products are pH sensitive. Coppers applied in spray tank water with pH less than 6.5 are likely to produce phytotoxicity.
	<i>copper hydroxide</i> Champion WP (50% MCE)	4.0-6.0 lbs		24 hrs/	Some copper hydroxide formulations have additional 7-day re-entry precautions – SEE LABELS for details.
	Nu-Cop 50DF (50% MCE)	8.0 lbs		24 hrs/	Plums are on most, but not all, copper labels. Check label before use.
	Champ Dry Prill (37.5% MCE)	5.0-8.0 lbs		24 hrs/	
	Kocide 2000 (35% MCE)	6.0-8.0 lb		24 hrs/	
	Kocide 3000 (30% MCE)	7.0 lbs		24 hrs/	“Low-rate” formulations of copper such as Copper-Count-N and Tenn-Cop 5E are best used post-bloom in cover sprays rather than in the pre-bloom sprays.
	Champ Formula 2 (24.4%)	8.0-10 pts		24 hrs/	
	<i>copper oxychloride plus basic copper sulfate</i> C-O-C-S WDG (50% MCE)	4.0-5.0 lbs		24 hrs/	

**DORMANT (continued)**

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Leaf curl (alone)	<i>ferbam</i> FRAC code M3 Ferbam Granuflo or <i>coppers</i> FRAC code M1 (% metallic copper equivalent=MCE) see copper recommendations for bacterial spot & leaf curl	3-4 lbs  formulated product/A	+++++  Bacterial Spot +++ Leaf Curl +++	24 hrs /21 days  24 hrs/21 days	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 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 lbs per acre for large trees. <b>Where plum pockets is a problem, use chlorothalonil or one of the copper products.</b>

**SCALE**—White peach and San Jose scale are serious pests. Scale overwinter on trees. Annual application of 2 dormant oil sprays provides very good control. Apply oil spray(s) dilute, 125 gallons/acre for mature trees. Early winter applications should be considered to assure spraying of all blocks. **Reduced rate oil sprays 1 – 1.5% (5 to 7.5 gals oil, in 500 gals of water, applied to 4 acres) are suggested early in the dormant season beginning after 95% of the leaves have fallen, and again in spring as buds swell and begin to break.** Reduced rate 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 60°F range, and the 2- to 3-day forecast does not include a harsh cold snap.** Monitor for scale crawlers by flagging limbs with numerous live scale. Flag monitoring limbs before oil sprays and bag them with plastic bags during oil applications to ensure survival of high numbers of live scale. 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 mite-like crawlers against a good visual background.

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Scale & European red mite	<i>superior oil</i>  <b>partially dormant trees</b>  <b>dormant trees</b>  or <i>superior oil</i>  plus  <i>pyriproxyfen</i> IRAC group 7C Esteem 35WP or Knack 0.86EC  or <i>buprofezin</i> IRAC group 16 Centaur 70W	<b>apply 125 gals final mix/acre</b> <b>5 to 7.5 gals oil/ 500 gal tank/ 4 acres (1–1.5%)</b>  <b>10 to 20 gals oil/ 500 gal tank/ 4 acres (2-4%)</b>  5 to 7.5 gals oil/ 500 gal tank/ 4 acres (1-1.5%)  4-6 ozs/acre 13-16 fl ozs/acre  34.5 oz/acre	+++++ when 2 sprays are applied  +++ when 1 spray is applied          +++++	12 hrs/pre-bloom only          12 hrs/14 days  12 hrs/14 days	All blocks, bearing and non-bearing, should receive at least one oil each dormant season. Two dormant oil applications will provide more dependable control.  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 60°F. Adjust oil rate down to 1 to 1.5% if you are spraying early or late in the dormant season.  Blocks which have heavy scale infestations should receive either two dormant oil applications, or a single reduced rate application of oil (1–1.5%) plus Centaur or Esteem/Knack applied to black cap stage scale.  The single most effective option is 1 to 1.5% oil plus Centaur or Esteem/Knack applied to black cap stage scale. Black cap stage scale are normally present in central GA and SC Ridge orchards by mid-January, but always confirm before applying either insect growth regulator (Knack/Esteem or Centaur). This combination provides control similar to two oil applications.  Esteem/Knack (pyriproxyfen) and Centaur (buprofezin) have distinctly different modes of action, so alternating these materials should slow the development of resistance.

## 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
<b>Weed Management</b> 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.
<b>Weed Management</b> Control winter annual weeds on the entire orchard floor. Elimination of winter annual weeds decreases catfacing insect populations.	<i>2,4-D</i> (various formulations)  or <i>clopyralid</i> Stinger or <i>paraquat</i> or <i>glyphosate</i>	1-1.5 qts   1/3 to 2/3 pt   see label	+++++   +++++	48 hrs/60 days   24 hrs/28 days in plums & nectarines, 24 hrs/14 days in peach	<b>Apply to the entire orchard floor 6 to 8 weeks prior to peach tree bloom for control of emerged winter annual weeds. Trees must be at least 1 year old. 2,4-D will control vetch, henbit, cutleaf evening primrose and Carolina geranium, which are hosts for two spotted spider mites. Stinger controls thistle, dandelion, clovers, vetch, sowthistle, and common groundsel. Stinger and 2,4-D may be tank mixed to get a broader spectrum control.</b>  Weeds that grow in a rosette will regrow after application with paraquat. Paraquat or glyphosate will kill or severely injure all plants growing on the orchard floor. DO NOT use paraquat or glyphosate if row middles are planted in a small grain cover crop or perennial grass sod you do not wish to kill.

## 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>FRAC code M1</i> (% metallic copper equivalent=MCE)  <i>basic copper sulfate</i> Cuprofix Ultra 40 Dispers (40% MCE)  <i>copper hydroxide</i> Champion WP (50% MCE) Nu-Cop 50DF (50% MCE) Champ Dry Prill (37.5% MCE) Kocide 2000 (35% MCE) Kocide 3000 (30% MCE) Champ Formula 2 (24% MCE)	   4.0-5.0 lbs   4.0-5.0 lbs 4.0-5.0 lbs 5.0-6.0 lbs 5.75-7.0 lbs 6.75-7.0 lbs 7.0-9.0 pts	Bacterial Spot +++ Leaf Curl +++	phytotoxicity concerns restrict copper uses to the recommended rates & phenologies  12 hrs/  24 hrs/ 24 hrs/ 24 hrs/ 24 hrs/ 24 hrs/	<b>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.</b>  Copper products are pH sensitive. Coppers applied in spray tank water with pH less than 6.5 are likely to produce phytotoxicity. Use 1.0-2.0 lbs MCE per acre applied in 75-125 gal water/acre.  Plums are on most, but not all, copper labels. Check label before use.  Some copper hydroxide formulations have additional 7-day re-entry precautions – SEE LABEL for details.

<b>DELAYED DORMANT – 1%-5% bud swell (continued)</b>					
<b>PEST(S)</b>	<b>MATERIAL(S)</b>	<b>FORMULATED PRODUCT/ACRE</b>	<b>EFFECTIVENESS</b>	<b>REI/PHI</b>	<b>REMARKS</b>
Bacterial spot & leaf curl (continued)	<i>copper oxychloride plus basic copper sulfate</i> C-O-C-S WDG (50% MCE)	3.0-4.0 lbs		24 hrs/	
Lesser peachtree borer Scale European red mite	<b>preferred option</b> <i>superior oil</i>  <b>plus</b> <i>chlorpyrifos</i> IRAC group 1B Chlorpyrifos 4E Lorsban 4E or <i>methidathion</i> IRAC group 1B Supracide 2E	2.5 to 7.5 gals oil/ 500 gal tank/ 4 acres (0.5-1.5%)  1.5-2 pts/acre  3-4 pts/acre	++++  ++++	4 days/do not apply after delayed dormant stage  2 days/do not apply after delayed dormant stage	<b>REDUCE OIL RATE TO 0.5 to 1.5% OIL BY VOLUME AFTER BUD SWELL TO REDUCE THE RISK OF PHYTOTOXICITY. DO NOT USE OIL AFTER 5% PINK BUD.</b>  Lorsban or Supracide each offer some suppression of lesser peachtree borer when applied at bud swell; they also enhance scale control when applied with oil at bud swell.
<b>Scale</b> European red mite	<i>superior oil</i>  plus <i>pyriproxyfen</i> IRAC group 7C Esteem 35WP or Knack 0.86EC or <i>buprofezin</i> IRAC group 16 Centaur 70W	2.5 to 7.5 gals oil/ 500 gal tank/ 4 acres (0.5-1.5%)  4-6 ozs/acre 13-16 fl ozs/acre  34.5 oz/acre	+++++  +++++	12 hrs/14 days  12 hrs/14 days	If only one dormant scale treatment is made, a combination of 0.5 to 1.5% oil plus Centaur or Esteem/Knack from black cap through delayed dormant is very effective.  Esteem/Knack (pyriproxyfen) and Centaur (buprofezin) have distinctly different modes of action; alternate these materials to slow the development of resistance.

PINK to 5% BLOOM					
PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Bacterial spot	<p><i>Coppers</i> FRAC code M1 (% metallic copper equivalent=MCE)</p> <p><i>basic copper sulfate</i> Cuprofix Ultra 40 Dispers (40% MCE)</p> <p><i>copper hydroxide</i> Champion WP (50% MCE) Nu-Cop 50DF (50% MCE) Champ Dry Prill (37.5% MCE) Kocide 2000 (35% MCE) Kocide 3000 (30% MCE) Champ Formula 2 (24% MCE)</p> <p><i>copper oxychloride plus basic copper sulfate</i> C-O-C-S WDG (50% MCE)</p>	<p>2.50–3.00 lbs</p> <p>2.0–2.75 lbs</p> <p>2.0-4.0 lbs</p> <p>2.5–4.5 lbs</p> <p>2.9–4.3 lbs</p> <p>3.0-4.0 lbs</p> <p>3.5-7.0 pts</p> <p>1.75-2.5 lbs</p>	Bacterial Spot +++	<p>phytotoxicity concerns restrict copper uses to the recommended rates &amp; phenologies</p> <p>12 hrs/</p> <p>24 hrs/</p> <p>24 hrs/</p> <p>24 hrs/</p> <p>24 hrs/</p> <p>24 hrs/</p> <p>24 hrs/</p>	<p><b>USE LOWEST RATES IF ANY BLOOM IS SHOWING.</b></p> <p><b>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.</b> Use 0.50-1.0 lbs MCE per acre applied in 75-125 gal water/acre.</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>Some copper hydroxide formulations have additional 7-day re-entry precautions – SEE LABEL for details.</p> <p>Plums are on most, but not all, copper labels. Check label before use.</p>
<p><b>BLACK KNOT</b>—<i>Dibotryon 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. <b>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 infested plum orchards.</b> 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	<p><i>chlorothalonil</i> FRAC code M5 Bravo Weather Stik (6 lbs/gal) or Equus 720 or ECHO 720</p> <p>or</p>	3-4 pts	+++	12 hrs/do not apply after shuck split	<p><b>Special Chlorothalonil Eye Irritation Provisions: Chlorothalonil is a severe eye irritant.</b> Although the restricted-entry interval expires after 12 hours, <b>for 7 days after use entry is permitted only when the following safety measures are provided.</b></p> <p>(1) At least one container designed specifically for flushing eyes must be available in operating condition at the WPS-required decontamination site intended for workers entering the treated area.</p> <p>(2) Workers must be informed, in a manner they can understand:</p> <ul style="list-style-type: none"> <li>that residues in the treated area may be highly irritating to their eyes.</li> <li>that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes</li> <li>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.</li> <li>how to operate the eyeflush container.</li> </ul>

<b>PINK to 5% BLOOM (continued)</b>					
<b>PEST(S)</b>	<b>MATERIAL(S)</b>	<b>FORMULATED PRODUCT/ACRE</b>	<b>EFFECTIVENESS</b>	<b>REI/PHI</b>	<b>REMARKS</b>
Black knot of plum (continued)	<i>thiophanate-methyl</i> FRAC code 1 Topsin-M 70W plus <i>captan</i> FRAC code M4 Captan 50W or Captec 4L	1.5 lbs  3 lbs 2 qts	+	4 days/0 days 24 hrs/0 days	<b>Use thiophanate-methyl only once per year, as resistance develops very readily to benzimidazole class fungicides.</b> Always tank-mix thiophanate-methyl with a fungicide having a different mechanism of action, such as captan.
<p><b>THRIPS—Thrips may be damaging to nectarines</b>, especially in dry springs. Russetting, a rough tan to brown thrips-induced callusing of the skin, occurs around bloom. As-needed thrips sprays are suggested for nectarines at pink and petal fall. <b>Thrips are seldom damaging to peaches, but consider treating at pink if thrips are extremely abundant.</b> Silvering is a smooth, light colored skin blemish. Silvering typically occurs when thrips numbers peak in early- to mid-May. If thrips are abundant in May and silvering is feared, treat nectarines. As peaches mature and redden, treat at the first sign of silvering if thrips are still abundant.</p>					
Thrips	as-needed <i>spinosad</i> IRAC group 5 SpinTor 2SC   <i>spinetoram</i> IRAC group 5 Delegate WG  or	4-6 fl ozs   4.5-7 ozs	+++  +++	4 hrs/14 days peach & nectarine, 4 hrs/7 days plums 4 hrs/14 days peach & apricot, 4 hrs/7 days plum & cherry, 4 hrs/24 hrs nectarine	<b>Thrips readily develop resistance to insecticides.</b> For pre-bloom thrips sprays, <b>spray only as-needed, and alternate IRAC #s (classes) with each application.</b> For example, Carzol (IRAC # 1A) followed by SpinTor (IRAC # 5) or Delegate (IRAC # 5). <b>Do not alternate SpinTor and Delegate, as they are from the same chemical class.</b>  SpinTor and Delegate are very safe and compatible with hand thinning at bloom. SpinTor and Delegate can be used with minimal risk to bees at pink bud stage by spraying after foraging has ceased in late afternoon to early evening.
<p><b>Worker Safety Caution—</b>Lannate, Carzol and endosulfan, are the most toxic insecticides labeled for use in stone fruit. Inhalation, ingestion, and/or eye contact are particularly dangerous. Loaders must be suited with chemical resistant gloves, aprons, goggles and respirators. Airblast applicators must be suited with gloves, goggles and respirators.</p>					
Thrips (continued)	<i>formetanate</i> IRAC group 1A Carzol 92SP  or  <i>methomyl</i> IRAC group 1A Lannate LV (2.4 WSL) Lannate SP (90% WSP)	1 lb   2-3 pts 0.67-1.0 lbs	+++  +++	REI: 16 days for hand thinning or pruning/do not apply after petal fall  4 days/4 days	Carzol is labeled for peaches and nectarine, but Carzol is not labeled for plums. Carzol may not be used after petal fall. Carzol may not be used in Florida. Carzol is highly toxic to bees, apply as-needed, preferably in late afternoon. Carzol REI specifics: 16-d hand thinning, pruning or topping, 10-d hand weeding or propping, 4-d for non-hand labor activities. Lannate products are labeled for peach, but Lannate is not labeled for use on plum or nectarine.

## BLOOM

### SAVE BEES and OTHER POLLINATORS—DO NOT APPLY INSECTICIDES DURING BLOOM

**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 present in trees in the winter. 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 Vangard. Do not use Orbit/Propimax, Elite, Indar (triazoles), Abound, or Pristine (QoIs) in bloom sprays. Use of these key brown rot materials before the pre-harvest period is strongly discouraged as a means to slow resistance development in these valued brown rot materials. Develop a resistance management strategy for each disease throughout the entire season.**

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Blossom blight	multi-site fungicides <i>Phthalimide</i> <i>captan</i> FRAC code M4 Captan 50W or Captec 4L or	4-6 lbs 2-2.5 qts	+++	4 days/0 days 24 hrs/0 days	Captan is active against scab, gummosis and blossom blight.
	<i>Substituted Aromatic</i> <i>chlorothalonil</i> FRAC code M5 Bravo Weather Stik (6 lbs/gal) or Bravo Ultrex (0.825 ai/lb) WDG or Bravo 500 (4 lbs/gal) or Equus 720 (6 lbs/gal) or ECHO 720 or	3-4 pts 2.8-3.8 lbs 4-6 pts 3-4 pts	++++	12 hrs/do not apply after shuck split	Chlorothalonil has long residual and is active against blossom blight, Botrytis and scab.  <b>Special Chlorothalonil Eye Irritation Provisions: Chlorothalonil is a severe eye irritant.</b> Although the restricted-entry interval expires after 12 hours, <b>for 7 days after use entry is permitted only when the following safety measures are provided.</b> (1) At least one container designed specifically for flushing eyes must be available in operating condition at the WPS-required decontamination site intended for workers entering the treated area. (2) Workers must be informed, in a manner they can understand: <ul style="list-style-type: none"> <li>• that residues in the treated area may be highly irritating to their eyes.</li> <li>• that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes</li> <li>• 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.</li> <li>• how to operate the eyeflush container</li> </ul>
	limited-site fungicides <i>Benzimidazole</i> <i>thiophanate-methyl</i> FRAC code I Topsin-M 70W or Topsin-M 70WSB or Thiophanate Methyl 85WDG plus  (continued)	1.25 lbs 1.25 lbs 1.0 lb	++++	12 hrs/1 day	<b>Use thiophanate-methyl only once per year, as resistance develops very readily to benzimidazole class fungicides.</b> Always tank-mix thiophanate-methyl with a fungicide having a different mechanism of action, such as captan.  Captan rates may be reduced to 3 lbs (50W) or 2 qts (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.

<b>BLOOM (continued)</b>					
<b>PEST(S)</b>	<b>MATERIAL(S)</b>	<b>FORMULATED PRODUCT/ACRE</b>	<b>EFFECTIVENESS</b>	<b>REI/PHI</b>	<b>REMARKS</b>
Blossom blight (continued)	<i>Phthalimide</i> <i>captan</i> FRAC code M4 Captan 50W or Captan 4L	3 lbs 2 qts		4 days/0 days 24 hrs/0 days	Captan rates may be reduced to 3 lbs (50W) or 2 qts (4L) when it is tank-mixed with thiophanate-methyl.
	<i>Dicarboximide</i> <i>iprodione</i> FRAC code 2 Rovral 4F  or <i>Anilinopyrimidine</i> <i>cyprodinil</i> FRAC code 9 Vanguard 75WG	2 pts      5 ozs	++++      see remarks	24 hrs/do not use after petal fall      12 hrs/do not use after bloom	<b>Use Rovral with caution, resistance is present in some orchards.</b> Do not use Rovral after petal fall on peaches or plums. Rovral also has activity against Botrytis.      Limit of 2 applications per season. Do not apply after bloom. Vanguard also has activity against Botrytis.
Black knot of plum	<i>chlorothalonil</i> FRAC code M5 Bravo Weather Stik (6 lbs/gal) or Equus 720 or ECHO 720 or <i>thiophanate-methyl</i> FRAC code 1 Topsin-M 70W or Topsin-M 70WSB or Thiophanate Methyl 85WDG plus <i>captan</i> FRAC code M4 Captan 50W or Captan 4L	3-4 pts      1.5 lbs 1.5 lbs 1.2 lbs  3 lbs 2 qts	+++      ++++	12 hrs/do not apply after shuck split      12 hrs/1 day    4 days/0 days 24 hrs/0 days	<b>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 ft. of orchards should be rogued.</b>  <b>Special Chlorothalonil Eye Irritation Provisions: Chlorothalonil is a severe eye irritant.</b> Although the restricted-entry interval expires after 12 hours, <b>for 7 days after use entry is permitted only when the following safety measures are provided.</b> (1) At least one container designed specifically for flushing eyes must be available in operating condition at the WPS-required decontamination site intended for workers entering the treated area. (2) Workers must be informed, in a manner they can understand: <ul style="list-style-type: none"> <li>that residues in the treated area may be highly irritating to their eyes.</li> <li>that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes</li> <li>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.</li> <li>how to operate the eyeflush container.</li> </ul> Always tank-mix thiophanate-methyl fungicides with a fungicide having a different mechanism of action, such as captan. Captan rates may be reduced to 3 lbs (50W) or 2 qts (4L) when it is tank-mixed with thiophanate-methyl.

**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>FRAC code M2</i>	9-12 lbs	++	24 hrs/0 days	Petal fall scab sprays are sometimes of little value. However, if conditions are particularly favorable for scab development, no strategy can undo infections that develop because of a missed spray.	
	or <i>chlorothalonil</i> <i>FRAC code M5</i> Bravo Weather Stik (6 lbs/gal)	3-4 pts	++++	12 hrs/do not apply after shuck split	Chlorothalonil has 14-21 day scab control residual.  <b>Special Chlorothalonil Eye Irritation Provisions: Chlorothalonil is a severe eye irritant.</b> Although the restricted-entry interval expires after 12 hours, <b>for 7 days after use entry is permitted only when the following safety measures are provided.</b> (1) At least one container designed specifically for flushing eyes must be available in operating condition at the WPS-required decontamination site intended for workers entering the treated area. (2) Workers must be informed, in a manner they can understand: <ul style="list-style-type: none"> <li>that residues in the treated area may be highly irritating to their eyes.</li> <li>that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes</li> <li>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.</li> <li>how to operate the eyeflush container.</li> </ul>	
	or Bravo Ultrex (0.825 ai/lb) WDG	2.8-3.8 lbs				
	or Equus 720 (6 lbs/gal) or ECHO 720	3-4 pts				
	or Bravo 500 (4 lbs/gal)	4-6 pts			48 hrs/do not apply after shuck split	
	or <i>captan</i> <i>FRAC code M4</i> Captan 50W or Captec 4L	4-6 lbs 2-3 qts	++++	4 days/0 days 24 hrs/0 days	Chlorothalonil is not labeled for use after shuck split.	
Bacterial spot	<i>Coppers</i> <i>FRAC code M1</i> (% metallic copper equivalent=MCE)		+++	phytotoxicity concerns restrict copper uses to the recommended rates & phenologies	<b>USE CAUTION IF COPPERS ARE USED POST-BLOOM. THE RECOMMENDED RATE REDUCTIONS LESSEN, BUT DO NOT ELIMINATE, PHYTOTOXICITY.</b>	
	<i>basic copper sulfate</i> Cuprofix Ultra 40 Disperss (40% MCE)	0.50-0.75 lbs		12 hrs/	<b>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.</b> Use 0.10-0.25 lbs MCE per acre applied in 75-125 gal water/acre.  Where coppers are used post-bloom, drying conditions should be excellent. Do not apply during extended dews or foggy conditions.	
	<i>copper hydroxide</i> Champion WP (50% MCE) Nu-Cop 50DF (50% MCE)	0.5-1.0 lb 1.0 lb			24 hrs/ 24 hrs/	Copper products are pH sensitive. Coppers applied in spray tank water with pH less than 6.5 are likely to produce phytotoxicity.
	Champ Dry Prill (37.5%)	0.75-1.25 lbs			24 hrs/	Plums are on most, but not all, copper labels. Check label before use.

**PETAL FALL TO 1% SHUCK SPLIT (continued)**

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Bacterial spot (continued)	Kocide 2000 (35% MCE)	0.80-1.0 lbs		24 hrs/	
	Champ Formula 2 (24% MCE)	1.0-1.25 pts		24 hrs/	
	Kocide 3000 (30% MCE)	0.75-1.0 lbs		24 hrs/	
	<i>copper oxychloride plus basic copper sulfate</i> C-O-C-S WDG (50% MCE)	0.25-0.75 lbs		24 hrs/	C-O-C-S WDG is not labeled for use after the petal fall spray.
Black knot of plum	<i>chlorothalonil</i> FRAC code M5 Bravo Weather Stik (6 lbs/gal) or Equus 720 or ECHO 720	3-4 pts	+++	12 hrs/do not apply after shuck split	<b>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 ft. of orchards should be rogued.</b>
	<i>thiophanate-methyl</i> FRAC code I Topsin-M 70W or Topsin-M 70WSB or Thiophanate Methyl 85WDG plus <i>captan</i> FRAC code M4 Captan 50W or Captan 4L	1.5 lbs 1.5 lbs 1.2 lbs  3 lbs 2 qts	++++	12 hrs/1 day   4 days/0 days 24 hrs/0 days	<b>Special Chlorothalonil Eye Irritation Provisions: Chlorothalonil is a severe eye irritant.</b> Although the restricted-entry interval expires after 12 hours, <b>for 7 days after use entry is permitted only when the following safety measures are provided.</b> (1) At least one container designed specifically for flushing eyes must be available in operating condition at the WPS-required decontamination site intended for workers entering the treated area. (2) Workers must be informed, in a manner they can understand: <ul style="list-style-type: none"> <li>that residues in the treated area may be highly irritating to their eyes.</li> <li>that they should take precautions, such as refraining from rubbing their eyes, to keep the residues out of their eyes</li> <li>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.</li> <li>how to operate the eyeflush container.</li> </ul>
Plant bugs Oriental fruit moth Plum curculio	Imidan, an <i>organophosphate</i> (IRAC group 1B), provides excellent control of plum curculio. Imidan should be the standard cover spray insecticide because: 1) it controls most key pests; 2) its acute worker toxicity and food safety profiles are good, 3) its use does not encourage mite and scale outbreaks, and 4) Imidan use helps protect the resistance-prone pyrethroid class.				
	<i>phosmet</i> Imidan 70W	2-2.25 lbs	++++	1 day/14 days for peach & nectarine, 1 day/7 days for plums	Imidan provides excellent control of plum curculio and Oriental fruit moth. It is only fair against plant bugs and stink bugs. At these rates Imidan does little to suppress scale or lesser peachtree borers.  Imidan efficacy may be reduced in spray solutions of pH 7 or higher. Buffering or acidifying agents are recommended as-needed.

### 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)	<p><i>Pyrethroids (IRAC group 3)</i> applied at petal fall at low to moderate rates provide excellent control of oriental fruit moth and good control of plant bugs. <b>Later in the season when plum curculio, borers and stink bugs are more abundant, higher pyrethroid rates are required.</b> Pyrethroid use often promotes scale and mite problems, to minimize mites and scale, <b>use pyrethroids as-needed within an Imidan-based program.</b> Pyrethroids can be damaging to non-target aquatic species; diligently avoid drift or run-off of pyrethroids to surface waters. Pyrethroids are resistance prone and should be alternated with Imidan to preserve pyrethroid efficacy.</p>				
	<i>esfenvalerate</i> Asana 0.66EC Adjourn 0.66EC	6-8 fl ozs 6-8 fl ozs	++++	12 hrs/14 days	At petal fall, when plant bugs are typically the most damaging species, pyrethroid rates may be reduced. Higher pyrethroid rates are necessary later when plum curculio, borers and stink bugs are more abundant.
	<i>beta cyfluthrin</i> Baythroid XL 1EC	2 fl ozs	++++	12 hrs/7 days	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.
	<i>zeta cypermethrin</i> (Mustang 1.5EC)	3 fl oz	++++	12 hrs/14 days	
	<i>cyfluthrin</i> Renounce 20WP Tombstone 2EC	2.5 ozs 2 fl ozs	+++	12 hrs/7 days	
	<i>gamma cyhalothrin</i> Proaxis 0.5EC	4 fl ozs	+++	24 hrs/14 days	Cyhalothrin products may be more inclined to cause dermatitis than other pyrethroid products.
	<i>lambda cyhalothrin</i> Lambda-T 1EC or Silencer 1EC or Taiga Z 1EC or Warrior 1EC	4 fl ozs 4 fl ozs 4 fl ozs 4 fl ozs	+++	24 hrs/14 days	Warrior and Lambda-T are encapsulated products, see label for mixing instructions.
	<i>permethrin</i> Ambush 25W (peach only) Pounce 25W (peach & nectarine) or Pounce 3.2EC (peach & nectarine)	19 ozs 19 ozs 12 ozs	++	12 hrs/14 days	Pounce and Ambush (permethrin) are only recommended at the highest rates; permethrin is typically the least effective peach pyrethroid.

### SHUCK SPLIT to 10% SHUCK OFF

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Bacterial spot	<i>oxytetracycline</i> FRAC code 41 Mycoshield 17W or FlameOut 17W or FireLine 17W or (continued)	0.75 lb 0.75 lb 0.75 lb	+++	12 hrs/21 days	<p><b>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.</b></p> <p><b>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.</b></p>

## SHUCK SPLIT TO 10% SHUCK OFF (continued)

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Bacterial spot (continued)	<p><i>Coppers</i> FRAC code M1 (% metallic copper equivalent=MCE)</p> <p><i>basic copper sulfate</i> Cuprofix Ultra 40 Disperss (40% MCE)</p> <p><i>copper hydroxide</i> Nu-Cop 50DF (50% MCE) Kocide 2000 (35% MCE) Kocide 3000 (30% MCE) Champ Formula 2 (24% MCE)</p> <p><i>copper ammonium complex</i> Copper-Count-N (8% MCE)</p> <p><i>copper salts of fatty and rosin acids</i> Tenn-Cop 5E (5.14% MCE)</p>	<p>0.25-0.65 lb</p> <p>0.2-0.5 lb</p> <p>0.3-0.7 lb</p> <p>0.25-0.50 lbs</p> <p>4.3-10.7 fl ozs</p> <p>0.5 pts</p> <p>4-6 fl ozs</p>	+++	<p>phytotoxicity concerns restrict copper uses to the recommended rates &amp; phenologies</p> <p>12 hrs/</p> <p>24 hrs/</p> <p>24 hrs/</p> <p>24 hrs/</p> <p>24 hrs/</p> <p>12 hrs/</p> <p>12 hrs/</p>	<p><b>COPPER PRODUCTS CAUSE LEAF SPOTTING. USE ONLY WHEN DRYING CONDITIONS ARE EXCELLENT.</b></p> <p><b>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.</b></p> <p><b>IF USED AFTER PETAL FALL, COPPERS SHOULD BE ALTERNATED WITH OXYTETRACYCLINE (FlameOut or Mycoshield).</b></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>Plums are on most, but not all, copper labels. Check label before use.</p> <p>Cuprofix Ultra 40 Disperss is not labeled for use after shuck split.</p> <p>Nu-Cop 50DF may be applied through second cover.</p> <p>Kocide 2000 and Kocide 3000 are not labeled for use after 2nd cover nor within 3 weeks of harvest, whichever occurs first. Other copper materials also may have similar restrictions – check labels before using.</p> <p>Based on the use of 0.5 pts in 100 gal of water.</p> <p>Tenn-Cop 5E may be applied in dilute sprays (but not in concentrate sprays) in a rate range of 4-6 fl ozs of product per acre based on 4 fl oz per 100 gal of water.</p> <p>Tenn-Cop 5E is labeled for post-bloom cover spray application to peaches and nectarines, but not for plums.</p> <p>Tenn-Cop 5E may be applied in up to 6 post-bloom applications. Do not tank mix Aliette, Topsin-M, diazinon or chelated or liquid fertilizers.</p>



### SHUCK SPLIT TO 10% SHUCK OFF (continued)

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Plant bugs Oriental fruit moth Plum curculio (continued)	<i>Pyrethroids (IRAC group 3)</i> Plum curculio, borers and stink bugs are more abundant after shuck split; accordingly, higher pyrethroid rates are required. Use pyrethroids as-needed to augment an Imidan-based program. Pyrethroids are resistance prone and should be alternated with Imidan to preserve pyrethroid efficacy.				
	<i>esfenvalerate</i> Asana 0.66EC Adjourn 0.66EC	10-14 fl ozs 10-14 fl ozs	+++ - ++++	12 hrs/14 days	Oriental fruit moth is easily controlled in southeastern peaches with 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.
	<i>beta cyfluthrin</i> Baythroid XL 1EC	2.8 fl ozs	++++	12 hrs/7 days	Cyfluthrin is a very good insecticide.
	<i>zeta cypermethrin</i> (Mustang 1.5EC)	3.8-4.3 fl oz	++++	12 hrs/14 days	Zeta cypermethrin is an excellent insecticide.
	<i>cyfluthrin</i> Baythroid 2EC Renounce 20WP Tombstone 2EC	2.8 fl ozs 3.5 ozs 2.8 fl ozs	+++	12 hrs/7 days	
	<i>gamma cyhalothrin</i> Proaxis 0.5EC	5 fl ozs	+++	24 hrs/14 days	Cyhalothrin products may be more inclined to cause dermatitis than other pyrethroid products.
	<i>lambda cyhalothrin</i> Lambda-T 1/EC (encapsulated) or Silencer 1/EC or Warrior 1/EC (encapsulated)	5 fl ozs 5 fl ozs 5 fl ozs	+++	24 hrs/14 days	Warrior and Lambda-T are encapsulated products, see label for mixing instructions.
	<i>permethrin</i> Ambush 25W (peach only) or Pounce 25W (peach & nectarine) or Pounce 3.2EC (peach & nectarine)	19 ozs 19 ozs 12 ozs	++	12 hrs/14 days	

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

**ANTHRACNOSE**—Anthracnose control is improved with programs that make use of chlorothalonil (cannot be used after shuck split), followed by captan- or QoI-containing products such as Pristine and Abound. QoIs are subject to rapid resistance development. If using QoIs for green fruit rot or anthracnose, make sure to alternate with captan, and then avoid use of QoIs for late-season brown rot as well. It is generally recommended that the QoIs 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.**

**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 QoIs be reserved for late-season pre-harvest sprays, but if utilized during cover sprays, it is very important to rotate captan with Abound and Pristine. 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 may increase severity of sooty peach.

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Red spot Sooty peach	<i>ziram</i> FRAC code M3 Ziram 76DF	4 lbs	+++	48 hrs/14 days	<b>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.</b> 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> FRAC code 41 Mycoshield 17W or FlameOut 17W or FireLine 17W <i>Coppers</i> FRAC code M1 (% metallic copper equivalent=MCE)  <i>copper ammonium complex</i> Copper-Count-N (8% MCE)  <i>copper salts of fatty and rosin acids</i> Tenn-Cop 5E (5% MCE)	0.75-1 lbs  0.75-1 lbs  0.75 lb    4.0-6.0 fl ozs  4 fl ozs	+++       +++	12 hrs/21 days       phytotoxicity concerns restrict copper uses to the recommended rates & phenologies  12 hrs/21 days  12 hrs/21 days	<b>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.</b> <b>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.</b>  <b>If coppers are used in summer cover sprays, always alternate with oxytetracycline, as alternating these materials reduces the risk of resistance.</b>  Copper products are pH sensitive. Coppers applied in spray tank water with pH less than 6.5 are likely to produce phytotoxicity.  Plums are on most, but not all, copper labels. Check label before use.  <b>Phytotoxicity is a risk,</b> but use of very low rates of liquid coppers, such as Copper-Count-N (4-6 fl oz/acre) or Tenn-Cop 5E (4 fl oz/acre), in a minimum of 100 gallons water per acre (do not use concentrate) 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. Tenn-Cop 5E may be applied up to 6 times post-bloom.

7 to 10 DAYS AFTER SHUCK SPLIT SPRAY (continued)					
PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Scab	sulfur <i>FRAC code M2</i> or <i>captan</i> <i>FRAC code M4</i> Captan 50W or Captec 4L	9-12 lbs  4-6 lbs 2-2.5 qts	+++  ++++	24 hrs/0 days  4 days/0 days 24 hrs/0 days	
Plum curculio Plant bugs Oriental fruit moth Lesser peachtree borer (suppression)	<i>Organophosphate</i> <i>IRAC group 1B</i> <i>phosmet</i> Imidan 70W <i>Neonicotinoid</i> <i>IRAC group 4A</i> <i>thiamethoxam</i> Actara 25WP  <i>Na channel blocker</i> <i>IRAC group 22</i> <i>indoxacarb</i> Avaunt 30SG	2-4 lbs  4.5-5.5 ozs  5-6 ozs	++++  ++++  ++++	1 day/14 days  12 hrs/14 days  12 hrs/14 days	Imidan should be the standard in-season insecticide. It provides very good control of plum curculio and oriental fruit moth. Modestly extending re-entry intervals in Imidan-treated blocks provides additional assurance of worker safety for thinning labor.  Actara is an effective, reduced risk, organophosphate replacement. Actara has a very desirable worker safety profile, accordingly, it is a good choice during thinning. Actara is limited to one post-bloom application.  Avaunt is an effective, reduced risk, organophosphate replacement. Avaunt has a very desirable worker safety profile, accordingly, it is a good choice during thinning.
<i>Pyrethroids (IRAC group 3)</i> Plum curculio, borers and stink bugs are more abundant after shuck split; accordingly, higher pyrethroid rates are required. Use pyrethroids as-needed to augment an Imidan-based program. Pyrethroids are resistance prone and should be alternated with Imidan to preserve pyrethroid efficacy.					
	<i>esfenvalerate</i> Asana 0.66EC Adjourn 0.66EC  <i>beta cyfluthrin</i> Baythroid XL 1EC  <i>zeta cypermethrin</i> (Mustang 1.5EC)  <i>cyfluthrin</i> Renounce 20WP Tombstone 2EC  <i>gamma cyhalothrin</i> Proaxis 0.5EC  <i>lambda cyhalothrin</i> Lambda-T 1EC or Silencer 1EC or Taiga Z 1EC or Warrior 1EC	10-14 fl ozs 10-14 fl ozs  2 fl ozs  1.3-4.3 fl oz  2.5 ozs 2 fl ozs  4 fl ozs  4 fl ozs 4 fl ozs 4 fl ozs 4 fl ozs	++++  ++++  ++++  +++  +++  +++	12 hrs/14 days  12 hrs/7 days  12 hrs/14 days  12 hrs/7 days  24 hrs/14 days  24 hrs/14 days	At petal fall, when plant bugs are typically the most damaging species, pyrethroid rates may be reduced. Higher pyrethroid rates are necessary later 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.  Zeta cypermethrin is an excellent insecticide.  Cyhalothrin products may be more inclined to cause dermatitis than other pyrethroid products.  Warrior and Lambda-T are encapsulated products, see label for mixing instructions.

<b>7 to 10 DAYS AFTER SHUCK SPLIT SPRAY (continued)</b>					
<b>PEST(S)</b>	<b>MATERIAL(S)</b>	<b>FORMULATED PRODUCT/ACRE</b>	<b>EFFECTIVENESS</b>	<b>REI/PHI</b>	<b>REMARKS</b>
Plum curculio  Plant bugs Oriental fruit moth Lesser peachtree borer (suppression) (continued)	<i>permethrin</i>  Ambush 25W (peach only) Pounce 25W (peach & nectarine) or Pounce 3.2EC (peach & nectarine)	19 ozs  19 ozs  12 ozs	++	12 hrs/14 days	Pounce and Ambush (permethrin) are only recommended at the highest rates; permethrin is typically the least effective peach pyrethroid.
Scale crawlers	<i>pyriproxyfen</i> <i>IRAC group 7C</i> Esteem 35WP or Knack 0.86EC  or <i>buprofezin</i> <i>IRAC group 16</i> Centaur 70W	4-6 ozs 13-16 fl ozs  34.5 ozs	++++	12 hrs/14 days	<b>Pyriproxyfen (Esteem or Knack) or Centaur (buprofezin) provide very good scale control if application coincides with crawler emergence. Timing is critical, control will be ineffective if application(s) of Esteem/Knack or Centaur are not timed to crawler emergence.</b>  Knack use is restricted to GA and FL.  Centaur is labeled for peach, but does not have nectarine or plum labels.
<b>Weed Management</b> 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 or second cover spray extends weed control into the summer.
<b>SUMMER COVER SPRAYS—14 day intervals are standard, may vary from 7-21 days depending on pest pressure/conditions.</b>					
<b>PEST(S)</b>	<b>MATERIAL(S)</b>	<b>FORMULATED PRODUCT/ACRE</b>	<b>EFFECTIVENESS</b>	<b>REI/PHI</b>	<b>REMARKS</b>
<b>Weed Management</b> Bermudagrass or Johnsongrass (May)	Fusilade DX or Poast 1.5EC	12 to 24 ozs  1.5 pts	+++++  ++++	12 hrs/14 days  12 hrs/24 hours non-bearing plums ONLY	Apply to actively growing weeds. Bermudagrass should have 4-8" long runners when applied. Johnsongrass should be 8-18" tall and 25" tall when using Fusilade and Poast, respectively.
<b>Weed Management</b> Escaped Weeds (May-June)	paraquat plus surfactant	dependent upon formulation	++++	24 hrs/28 days plums/nectarine 24 hrs/14 days peach	In the event weeds become a problem 4-8 weeks before harvest, use paraquat for control. Research indicates weed populations 4-8 weeks prior to harvest can reduce fruit size and marketable yield.

## SUMMER COVER SPRAYS (continued)

**BACTERIAL SPOT**—Sprays are critical from mid-May to early June to prevent large 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 QoIs for pre-harvest brown rot management. QoIs are subject to rapid resistance development. If using Abound or Pristine for green fruit rot or anthracnose, be especially careful to follow resistance management guidelines, and do not use for late season brown rot as well.

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Bacterial spot	as-needed				Moisture is very conducive to bacterial spot infection. Unfortunately, oxytetracycline's (Mycoshield or FlameOut 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 with 21 days of harvest.  <b>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.</b>  <b>If coppers are used in summer cover sprays, always alternate with oxytetracycline, as alternating these materials reduces the risk of resistance.</b>  Copper products are pH sensitive. Coppers applied in spray tank water with pH less than 6.5 are likely to produce phytotoxicity.  Plums are on most, but not all, copper labels. Check label before use.  <b>Phytotoxicity is a risk</b> , but use of very low rates of liquid coppers, such as Copper-Count-N (4-6 fl oz/acre) or Tenn-Cop 5E (4 fl oz/acre), in a minimum of 100 gallons water per acre (do not use concentrate) 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.
	<i>oxytetracycline</i> <i>FRAC code 41</i>		+++	12 hrs/21 days	
	Mycoshield 17W or FlameOut 17W or FireLine 17W	0.75 lb  0.75 lb  0.75 lb			
	or <i>Coppers</i> <i>FRAC code M1</i> (% metallic copper equivalent=MCE)		+++	phytotoxicity concerns restrict copper uses to the recommended rates & phenologies	
	<i>copper ammonium complex</i> Copper-Count-N (8% MCE)	4-6 fl ozs		12 hrs/21 days	
	<i>copper salts of fatty and rosin acids</i> Tenn-Cop 5E (5% MCE)	4 fl ozs		12 hrs/21 days	

**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. In middle GA, dates for scouting for females with eggs and crawlers should begin at the following dates: first generation: 1 Apr, second generation: 20 May, third generation: 20 July, fourth generation: 20 Aug, fifth generation: 20 Sept.

**ORIENTAL FRUIT MOTH**—Pheromone traps may be used to monitor for OFM populations. In middle GA, varieties later than Harvester are more commonly 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.

SUMMER COVER SPRAYS (continued)					
PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Scab	sulfur	9-12 lbs	+++	24 hrs/0 days	Sulfur will only control scab.
Scab and Green fruit rot	<i>FRAC code M2</i> or <i>captan</i> <i>FRAC code M4</i> Captan 50W or Captec 4L	4-6 lbs 2-3 qts	++++	4 days/0 days 24 hrs/0 days	Captan products provide enhanced scab and green fruit rot control.
Anthracnose	<i>captan</i> <i>FRAC code M4</i> Captan 50W or Captec4L	4-6 lbs 2-3 qts	+++	4 days/0 days 24 hrs/0 days	If your farm, or particular blocks, has a history of anthracnose, apply captan cover sprays during extended periods of wet weather.
Plant bugs Stink bugs Oriental fruit moth Plum curculio Lesser peachtree borer (suppression)	<i>Pyrethroids (IRAC group 3)</i> Plum curculio, borers and stink bugs are more abundant after shuck split; accordingly, higher pyrethroid rates are required. Use pyrethroids as-needed to augment an Imidan-based program. Pyrethroids are resistance prone and should be alternated with Imidan to preserve pyrethroid efficacy.				
	<i>esfenvalerate</i> Asana 0.66EC Adjourn 0.66EC	10-14 fl ozs 10-14 fl ozs	++++	12 hrs/14 days	At petal fall, when plant bugs are typically the most damaging species, pyrethroid rates may be reduced. Higher pyrethroid rates are necessary later when plum curculio, borers and stink bugs are more abundant.
	<i>beta cyfluthrin</i> Baythroid XL 1EC	2 fl ozs	++++	12 hrs/7 days	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.
	<i>zeta cypermethrin</i> (Mustang 1.5EC)	1.4-4.3 fl oz	++++	12 hrs/14 days	Zeta cypermethrin is an excellent insecticide.
	<i>cyfluthrin</i> Renounce 20WP Tombstone 2EC	2.5 ozs 2 fl ozs	+++	12 hrs/7 days	
	<i>gamma cyhalothrin</i> Proaxis 0.5EC	4 fl ozs	+++	24 hrs/14 days	Cyhalothrin products may be more inclined to cause dermatitis than other pyrethroid products.
	<i>lambda cyhalothrin</i> Lambda-T 1EC or Silencer 1EC or Taiga Z 1EC or Warrior 1EC	4 fl ozs 4 fl ozs 4 fl ozs 4 fl ozs	+++	24 hrs/14 days	Warrior and Lambda-T are encapsulated products, see label for mixing instructions.
	<i>permethrin</i> Ambush 25W (peach only) Pounce 25W (peach & nectarine) or Pounce 3.2EC (peach & nectarine)	19 ozs 19 ozs 12 ozs	++	12 hrs/14 days	Pounce and Ambush (permethrin) are only recommended at the highest rates; permethrin is typically the least effective peach pyrethroid.

## SUMMER COVER SPRAYS (continued)

**SPIDER MITES**—Peaches are more tolerate of moderate mite populations than plums, apples or pears. Two spotted spider mite is the most common mite pest of southeastern peach; 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. Overcropping, drought and other stresses justify lower treatment thresholds. Pyrethroids (Ambush, Asana, Baythroid, Pounce, Proaxis, Warrior), 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 down to 3 days. Curative miticides (Acramite, Nexter or Vendex) are the materials of choice for most mite problems in peach.** In rare circumstances, heavy early- to mid-season mite infestations may justify application of Apollo or Savey.

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Spider mites  Two spotted spider mite (primary SE peach mite) or European red mite	<i>bifenazate</i> IRAC group 25 Acramite 50WS	0.75-1 lb	+++++	12 hrs/3 days	Acramite is a very good curative miticide, especially against two spotted spider mite. Acramite has provided good control of two spotted 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> IRAC group 21 Nexter 75WP	8.8-10.6 ozs	++++	12 hrs/7 days	Nexter is very effective against European red mite; lower rates, 4.4-8.8 ozs/A Nexter, should control European red mite.
	<i>spirodiclofen</i> IRAC group 23 Envidor 2SC	16 ozs	++++	12 hrs/7 days	Envidor is a very good curative miticide. It may be more active against eggs and nymphs than adults.
	<i>cyhexatin</i> IRAC group 12B Vendex 50WP	1-2 lbs	+++	2 days/14 days	Vendex is generally a reliable miticide.
	<i>clofentezine</i> IRAC group 10A Apollo 0.42SC or <i>hexythiazox</i> IRAC group 10B Savey 50DF	4 ozs  3 ozs	++++  ++++	12 hrs/21 days  12 hrs/28 days	Apollo and Savey are excellent <b>preventative miticides</b> . Apollo (10A) and Savey (10B) have similar toxic modes of action. If you use either as a standard, preventative treatment, mite control in the year between use of Apollo or Savey should consist of dormant oil(s) and as-needed curative miticides (Acramite, Nexter, Envidor or Vendex). Apply these products before mites build up. Apollo and Savey control mite eggs and early immature mite stages; they do not control adult mites. If Apollo or Savey is applied to active mite infestations, <b>do not expect mite numbers to be visibly reduced for around 10 days</b> . Apollo is labeled for peaches and nectarines, but not for plums. Savey is labeled for peaches, nectarines and plums.

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

Pre-harvest watersprout removal promotes increased fruit size and red fruit color. 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.** Pre-harvest watersprout removal also increased fruit bud formation for next year's crop. Responses may be reduced in years of very high rainfall and/or tree vigor.

**Remove all watersprouts which are  $\geq 45^\circ$  more upright than the scaffold limb they originate from. Retain a few watersprouts to shade the scaffolds, take care to maintain shading of southwest facing scaffolds.**

## 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.

Physical injuries, particularly abrasion, bruising, sun injury, may contribute to discoloration. Excessive rainfall, sun injury and high harvest temperatures have also been associated with skin discoloration. When skin cells of maturing fruit are damaged, they can release anthocyanin/phenolic pigments that may react with heavy metals, turning the skin brown or purple-to-black.

Iron-, copper- and aluminum-containing materials, either sprayed on the fruit to control pests, applied as foliar nutrients, or as contaminants in hydrocooler or wash water, have frequently been associated with inking.

Inking risks associated with abrasion are compounded by contamination of the skin during the period from 3 weeks pre-harvest through cooling and packing. Fruit which 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.

Application of captan, Topsin-M®, Elite®, Acramite® or carbaryl within 3-weeks of harvest may increase the risk of inking. Highly colored fruit are more susceptible to discoloration. Packing and cooling processes are important sources of injury/contamination associated with skin discoloration. Hydrocooler management is important. Hydrocoolers with excessive chlorination, pHs under 6.5 or dirty cooler water increase the risk of fruit discoloration.

### MINIMIZE INKING OR OTHER PEACH SKIN DISCOLORATIONS BY:

1. **LIMIT PRE-HARVEST APPLICATION** of captan, Topsin-M®, Elite®, Acramite® or carbaryl ( $\leq$  21-days pre-harvest). Use of these materials within 21-days of harvest should be made with due consideration of increased inking risks. Label pre-harvest intervals (PHIs) assure dietary safety in harvest fruit, but they are completely independent of, and do not speak to, inking risk. Avoid pesticide applications when wet, slow drying conditions prevail.
2. **HANDLE FRUIT CAREFULLY**—Abrasions sustained during picking, hauling, grading and packing operations clearly increase the risk of discoloration. Supervise labor to minimize bruising and abrasion during picking. 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. Reduce physical injury from vibration, rubbing or rolling of fruit.
3. **KEEP HYDROCOOLERS AND DUMPTANKS AS CLEAN** as possible. Excessive iron in treatment water is a common cause of skin discoloration. Rust in hydrocoolers and dumptanks can result in high levels of rust in water. Keeping pH levels above 6.5 should minimize risk of iron-related inking. Flush out hydrocoolers and dump tanks daily, refilling with clean water, removing dirt, leaves and other debris and refilling with clean water.
4. **MAINTAIN DUMPTANK/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 the risk of iron-related inking is felt to be dramatically reduced. If you have pH problems, use a high grade swimming pool chlorine that contains calcium hypochlorite. Water at pH 4-6 is more prone to discoloration. At a pH less than 5.2, Iron exists in a soluble, discoloration-prone ferrous state (Fe+2).
5. **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 important.
6. **AVOID EXPOSURE TO AMMONIA AND SULFUR DIOXIDE**—Fruit are quite susceptible to skin discoloration if exposed to ammonia (NH<sub>3</sub>), and/or sulfur dioxide (SO<sub>2</sub>) gases.

**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 even just before or during harvest (if multiple pickings occur).

**BROWN ROT**—Good pre-harvest fungicide programs are essential. Brown rot very readily develops resistance to fungicides. Alternating multiple fungicide classes in a well considered fashion avoids repetitive exposure of the fungus to the same toxic mode of action and is the most practical approach to resistance management. Brown rot has well documented resistance to the benzimidazole fungicide class [thiophanate-methyl (Topsin-M)]. Brown rot isolates from some Georgia orchards have developed modest levels of resistance to the triazole (DMI) fungicide class [propiconazole (Orbit/Propimax), fenbuconazole (Indar) and tebuconazole (Elite)]. Resistance to triazole fungicides brings a gradual loss of effectiveness. Even though incipient resistance may have begun to develop, the triazole fungicides remain vitally important to good brown rot control. QoIs: azoxystrobin (Abound) and Pristine, a pre-mixed combination material made up of pyraclostrobin plus boscalid (from the unrelated anilide class) are also key pre-harvest brown rot fungicides. Even though there is no brown rot resistance to QoIs, this class is very susceptible to resistance. QoI resistance is usually rapid and complete. Without Abound and Pristine, the triazoles are almost certain to succumb to major, perhaps catastrophic levels of brown rot resistance. Outlined below are the pre-harvest fungicides recommended to slow development of fungicide-resistant brown rot strains.

**‘Profile’ is a science-based survey tool 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. Selecting the wrong brown rot fungicide can be avoided by implementing effective anti-resistance spray strategies. ‘Profile’, a joint Clemson University and University of Georgia program, can identify the cheapest effective spray program for brown rot control for your operation based on your individualized resistance profile. In addition, Profile counteracts selection for fungicide resistance, making disease management and your operation more sustainable for the future.

‘Profile’ determines the sensitivity of the local *Monilinia* population to the most commonly used fungicide classes for brown rot management: the benzimidazoles (e.g., Topsin M), the demethylation inhibitors (e.g. Orbit), and the quinone outside inhibitors (e.g., Pristine). 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 grew on fungicide-amended medium, it would be considered resistant. The resistance profile may change from one season to another depending on the spray history.

Note that this service **cannot** be provided free of charge. For more information contact Guido Schnabel 864 656 6705; 864 643 7131 (cell); schnabe@clemson.edu.

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
<b>Pre-Harvest Fungicide Use-Pattern for Low Brown Rot Pressure (very dry season with limited or no blossom blight or green fruit rot)</b>					
Brown rot					
21 days pre-harvest	<i>Phthalimide</i> <i>captan</i> FRAC code M4 Captan 50W or Captan 4L	5-8 lbs 5-8 pts	+++	4 days/0 days 24 hrs/0 days	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.
14 days pre-harvest	<i>QoI/Carboxamide mix</i> <i>pyraclostrobin</i> FRAC code 11 <i>plus</i> <i>boscalid</i> FRAC code 7 Pristine 38W	10.5-14.5 ozs	+++++	12 hrs/0 days	
1-7 days pre-harvest	<i>Triazoles</i> FRAC code 3 <i>propiconazole</i> Bumper 41.8EC Orbit 3.6E PropiMax EC or	4 fl ozs	+++++	24 hrs/0 days	Do not apply PropiMax to cherries or ‘Stanley’ type plums. PropiMax is not labeled for use in Florida.

**PRE-HARVEST (continued)****Pre-Harvest Fungicide Use-Pattern for Low Brown Rot Pressure (very 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>tebuconazole</i> Elite 45DF Orius 45DF Tebuzol 45DF or <i>fenbuconazole</i> Indar 75WSP	4 ozs	+++++	12 hrs/0 days	On larger trees, the per acre rate may be increased to 8 oz for all formulations. Tebuconazole products (Elite, Orius, Tebuzol) have been associated with inking in some production areas.
		2 ozs	+++++	12 hrs/0 days	

**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)**

21 days pre-harvest	<i>QoI</i> <i>azoxystrobin</i> FRAC code 11 Abound 2.08F	15.4 fl ozs	++++	4 hrs/0 days	Do not use Abound in sprayers that will be used for apples.
14 days pre-harvest	<i>QoI/Carboxamide mix</i> <i>pyraclostrobin</i> FRAC code 11 plus <i>boscalid</i> FRAC code 7 Pristine 38W	10.5-14.5 ozs	+++++	12 hrs/0 days	
1-7 days pre-harvest	<i>Triazoles</i> FRAC code 3 <i>propiconazole</i> Bumpers 41.8EC Orbit 3.6EC Propimax EC or	4 fl ozs	+++++	24 hrs/0 days	Do not apply PropiMax to cherries or 'Stanley' type plums. PropiMax is not labeled for use in Florida.  On larger trees, the per acre rate may be increased to 8 oz for all formulations. Tebuconazole products (Elite, Orius, Tebuzol) have been associated with inking in some production areas.
	<i>tebuconazole</i> Elite 45DF Orius 45DF Tebuzol 45DF or	4 ozs	+++++	12 hrs/0 days	
	<i>fenbuconazole</i> Indar 75WSP	2 ozs	+++++	12 hrs/0 days	

**Pre-Harvest Fungicide Use-Pattern for Moderate to Heavy Brown Rot Pressure in areas with documented or suspected DMI resistance (Triazoles are DMIs)**

21 days pre-harvest	<i>Triazoles</i> FRAC code 3 <i>tebuconazole</i> Elite 45DF Orius 45DF Tebuzol 45DF or	8 ozs	+++++	12 hrs/0 days	Higher rates of DMI fungicides will control DMI resistant populations.  If benzimidazole resistance is not suspected or documented at a given location, a tank mixture of Captan AND Topsin M or other formulations of a benzimidazole may be used at this time (see blossom blight section for details on rates and formulations). Tebuconazole and captan fungicides have occasionally been associated with inking of fruit.
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**PRE-HARVEST (continued)****Pre-Harvest Fungicide Use-Pattern for Moderate to Heavy Brown Rot Pressure in areas with documented or suspected DMI resistance (Triazoles are DMIs) (continued)**

PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
21 days pre-harvest (continued)	<i>fenbuconazole</i> Indar 75WSP (Georgia only)	4 ozs	+++++	12 hrs/0 days	Georgia has a 24C registration allowing application of Indar75WSP at 4 ozs/acre.
14 days pre-harvest	<i>QoI/Carboxamide mix</i> <i>pyraclostrobin</i> FRAC code 11 plus <i>boscalid</i> FRAC code 7 Pristine 38W	10.5-14.5 ozs	+++++	12 hrs/0 days	
1-7 days pre-harvest	<i>Triazoles</i> FRAC code 3  <i>tebuconazole</i> Elite 45DF Orius 45DF Tebuzol 45DF or <i>fenbuconazole</i> Indar 75WSP (Georgia only)	8 ozs  4 ozs	+++++  +++++	12 hrs/0 days  12 hrs/0 days	Tebuconazole products (Elite, Orius, Tebuzol) have been associated with inking in some production areas.  Georgia has a 24C registration allowing application of Indar75WSP at 4 ozs/acre.
Rhizopus rot Botrytis rot	<i>Nitroaniline</i> <i>dicloran</i> FRAC code 14 Botran 75W	1.33-5.33 lbs	+++	12 hrs/10 days	Rhizopus and botrytis rots are uncommon in many southeastern production areas. Often they are more of a problem in cool, moist years. Botran is not labeled for post-bloom use on plum. Even at maximum rates, <b>Botran is not effective for brown rot control.</b> In cool wet weather, Botran has some activity for botrytis.
Anthracnose	<i>QoI</i> <i>azoxystrobin</i> FRAC code 11 Abound 2.08F <i>QoI/Carboxamide mix</i> <i>pyraclostrobin</i> FRAC code 11 plus <i>boscalid</i> FRAC code 7 Pristine 38 WG	12.3-15.4 fl ozs  10.5-14.5 ozs	+++  ++++	4 hrs/0 days  12 hrs/0 days	Anthracnose can infect fruit prior to harvest if conditions are wet and warm. Both Abound and Pristine are labeled for anthracnose, and use in the early brown rot sprays would provide control of brown rot and likely result in suppression of anthracnose. However, testing has not been conducted under southeastern conditions, so efficacy data is not available. <b>Captan use during the cover sprays is recommended as well where anthracnose is a problem, and it is recommended that the QoI-containing 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.</b> Captan has been associated with some instances of fruit inking.

PRE-HARVEST (continued)					
PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Insects	<i>phosmet</i> <i>IRAC group 1B</i> Imidan 70W (@ 14 or more days PH)	2.25-3 lbs	++++	3 days/14 days	<b>Imidan application, as a complete spray to both sides of each tree row, should be standard practice at 14 days pre-harvest.</b> Imidan has in a few instances been associated with fruit inking.
<b>AS NEEDED 3-7 DAY PRE-HARVEST INSECTICIDE</b>					
A 14-day pre-harvest Imidan application is often satisfactory through harvest. However, if insects are present pre-harvest, they increase brown rot pressure, especially in wet weather. Apply Renounce, Baythroid, Tombstone, malathion, Sevin or Provado (June beetle control only) as-needed when insect injury is occurring with less than 14 days to harvest.					
Assorted Pre-harvest Insects	<i>beta cyfluthrin</i> <i>IRAC group 3</i> Baythroid XL 1EC  <i>cyfluthrin</i> <i>IRAC group 3</i> Renounce 20WP Baythroid 2EC Tombstone 2EC  <i>malathion</i> <i>IRAC group 1B</i> Malathion 57EC or <i>carbaryl</i> <i>IRAC group 1A</i> Sevin 80S	2.8 fl ozs  3.5 ozs 2.8 fl ozs 2.8 fl ozs  2 pts  2-3 lbs	++++  +++  +  ++	12 hrs/7 days  12 hrs/7 days  24 hrs/7 days  12 hrs/3 days	Renounce is a wettable powder formulation, which typically offers some fruit finish advantages over emulsifiable concentrate formulations. Use of cyfluthrin products may encourage scale and mite outbreaks.  Malathion use has not resulted in fruit finish problems, however, avoid use during slow drying conditions to minimize chances of phytotoxicity. Malathion is labeled for peaches and nectarines, but some labels do not list plums. Carbaryl has been associated with occasional inking of fruit.  Sevin use may encourage scale and mite outbreaks.
Scarab beetles: Japanese beetles June beetles Rose chafer	<i>IRAC group 4A</i> + <i>IRAC group 3</i> Leverage 1.6EC imidacloprid + 1.1EC cyfluthrin  <i>imidacloprid</i> <i>IRAC group 4A</i> Couraze 1.6F Nuprid 1.6F Pasada 1.6F Provado 1.6F or <i>carbaryl</i> <i>IRAC group 1A</i> Sevin 80S	5.1 fl ozs  4-8 ozs  2-3 lbs	+++  ++	12 hrs/7 days  12 hrs/0 days peach & nectarine, 12 hrs/7 days plum & cherry  12 hrs/3 days	Leverage has not been tested on peaches in GA or SC. Leverage combines two active ingredients, at appropriate rates, either material alone provides good control of Japanese and/or June beetles. Imidacloprid provides good control of scarab beetles: June beetle, Japanese beetle and rose chafer, but imidacloprid does not control other common pre-harvest peach insects. Use of imidacloprid may encourage mite problems.  Sevin use may encourage scale and mite outbreaks.

## 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  <i>sodium hypochlorite</i> AgClor 310	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 lbs/1000 gal of water. There are 7.48 gals per cubic ft of water. To avoid tank erosion and scaling, maintain water balance. Consult your county Extension agent.
			+++++	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.
Brown rot Rhizopus rot Gilbertella rot Botrytis rot	<i>fludioxonil</i> FRAC code 12 Scholar 50%	8-16 ozs/ 200,000 lbs 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 generally 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 lbs 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 lbs 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 lbs of fruit.
	Scholar SC	16 fl oz/200,000 lbs fruit	+++++	N/A	

## POST-HARVEST TREE PESTS

**LESSER PEACHTREE BORER (LPTB)** has become a debilitating key pest in GA and SC, likely because of changes in cover spray availability. 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 October. 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.

LPTB control options are limited and preventative. It is quite important to protect trees from LPTB. The most effective LPTB control programs rely on a combination of preventative chlorpyrifos sprays for LPTB applied pre-bloom and again post-harvest (24C label in GA & SC), aggressive full-season cover spray programs. While quite expensive, where feasible, pheromone mating disruption with Isomate-L pheromone ties 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, often April and May, helps suppress lesser peachtree borer.

## POST-HARVEST TREE PESTS (continued)

**PEACHTREE BORER (PTB)** is a very important pest. Some reduction in control may be attributable to less effective cover spray suppression with Imidan-based programs, but PTB control is generally good where a single yearly, post-harvest, handgun butt spray is made. PTB's injury potential is quite high since its larvae infest the lower trunk and primary roots near the tree's crown. Fortunately, PTB infestations are restricted to these readily treated areas, and PTB's egg-laying period covers much of the summer and early fall. Applying chlorpyrifos on a block-to-block basis as soon after harvest as is feasible should give 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 chlorpyrifos applied every year. Begin PTB sprays in an orchard's year of establishment. Butt sprays should pool up at the base of the tree. Application volumes of 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 poor application technique for PTB sprays.** Two handgun sprays with esfenvalerate (Asana) or endosulfan (Thiodan/Phaser) may be used in lieu of a single chlorpyrifos application. Pheromone mating disruption treatments with Isomate-L typically provide very good PTB control. In blocks employing pheromone mating disruption with Isomate-L, and carefully monitoring by IPM professionals, it will often be feasible to eliminate handgun chlorpyrifos application.

**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) have been serious pests throughout the Southeast since adoption of Imidan- and esfenvalerate (Asana and Adjourn)-based cover spray programs. 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. Higher rates provide an incremental improvement in control, but two applications of dormant oil typically outperform a single, high-rate application.

**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 two spotted 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 and Scale	<i>chlorpyrifos</i> <i>IRAC group 1B</i> MicroFlo Chlorpyrifos 4E-AG (GA & SC 24C labels)  Isomate-L (pheromone mating disruption ties)	3-6 pts  February & July applications 100-200 ties/ acre	++  +++ (LPTB) +++ (PTB)	4 days/post-harvest only	In GA and SC, 24C labels allow an additional 1 to 2 dilute (125 gal/acre) air blast application(s) after harvest and again in September. Do not use in other states. These sprays are recommended in addition to the handgun-applied PTB spray in August.  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.
Peachtree borer	1 application of <i>chlorpyrifos</i> <i>IRAC group 1B</i> Lorsban 4E Chlorpyrifos 4E Chlorpyrifos 4E AG or 2 applications of <i>esfenvalerate</i> <i>IRAC group 3</i> Asana 0.66 EC Adjourn 0.66 EC or	3-6 pts/100 gals  9-14 fl oz 9-14 fl oz	+++++  ++	4 days/ recommended for post-harvest use only  12 hrs/14 days	Peachtree borer sprays are much more effective when applied as a directed, handgun application to the lower scaffolds, vase and trunk. Lesser peachtree borer infestations concentrated in the areas where primary scaffolds split also benefit from thorough coverage, particularly in older orchards.  <b>Chlorpyrifos is the material of choice.</b> The 3 pt/100 gals rate is normally adequate.

POST-HARVEST TREE PESTS (continued)					
PEST(S)	MATERIAL(S)	FORMULATED PRODUCT/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Peachtree borer (continued)	2 applications of <i>endosulfan</i> <i>IRAC group 2A</i> Thiodan 3EC or Phaser 3EC	4-6 pts/100 gals 4-6 pts/100 gals	++	4 days/ recommended for post-harvest use only	
Scale (alone)	<i>diazinon</i> <i>IRAC group 1B</i> Diazinon AG-500	3 pts	+++	24 hrs/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 scale control when applied at the beginning of crawler emergence. Apply diazinon as a dilute spray. Check infested limbs for crawler emergence before applying.
	<i>summer oil</i> Saf-T-Side	1 to 1.5% by volume, 1.25 to 1.9 gals/125 gals spray	++	4 hrs/ recommended post-harvest only	Apply dilute, at least 125 gals per acre. Do not apply when fruit is present or daytime temperatures reach the high 90°s. <b>Do not apply within 2 weeks of applying sulfur, captan or Sevin.</b>
	<i>superior oil</i>	apply 125 gals final mix/acre	+++++ when 2 sprays are applied	12 hrs/ not recommended until after leaf fall	<b>Adjust oil rate downward when spraying during early- or late-dormancy.</b> In GA and SC, all blocks, bearing and non-bearing, should receive at least one dormant oil application. A second dormant oil application will greatly improve scale control.
	<b>partially dormant trees</b>	<b>5 to 7.5 gals oil/ 500 gal tank/ 4 acres (1-1.5%)</b>	+++ when 1 spray is applied		Partially dormant is defined as after 95% leaf drop and some early winter cold.
	<b>dormant trees</b>	<b>10 to 20 gals oil/ 500 gal tank/ 4 acres (2-4%)</b>			

## POISON CONTROL CENTERS AND EMERGENCY FACILITIES

Nationwide Poison Control 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/>

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

(+++++ = 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	Class	Leaf curl	Bacterial spot	Blossom blight	Scab	Anthracnose	Red spot	Sooty peach	Brown rot	Rhizopus rot
Abound	QoI (quinone outside inhibitor)	-	-	-	++++ Resistance a threat	++++	-	-	++++ Resistance a threat	-
coppers	multi-site toxins	+++	+++ Resistance a threat	-	-	-	-	-	-	-
Botran	multi-site toxin	-	-	+	-	-	-	-	+	++
Mycoshield FlameOut FireLine	antibiotic	-	+++ Resistance a threat	-	-	-	-	-	-	-
captan	multi-site toxin	-	-	++	++++	+++	-	++	+++	+
Ferbam	multi-site toxin	+++++	-	-	-	-	+++	-	-	-
Thiram	multi-site toxin	+++	-	-	-	-	+++	-	-	-
Ziram	multi-site toxin	+++	+	-	+	-	+++	+++	-	-
sulfur	multi-site toxin	-	-	+	+++	-	-	-	+	-
chlorothalonil	multi-site toxin	++++	-	+++	++++	-	-	-	-	-
Rovral	dicarboximide	-	-	++++	-	-	++	++	-	-
Elite Orius Tebuzol	DMI (dimethylation inhibitor)	-	-	+++++	-	-	-	-	+++++ Resistance a threat	-
Indar Quash	DMI	-	-	+++++	++	-	-	-	+++++ Resistance a threat	-
Nova	DMI	-	-	+++	-	-	-	-	-	-
Orbit PropiMax Bumper	DMI	-	-	+++++	-	-	-	-	+++++ Resistance a threat	-
Topsin-M and Thiophanate Methyl	MBC (methyl benzimidazole carbamate)	-	-	++++ Resistance a threat	++++ Resistance a threat	-	-	-	+++ Resistance a threat	-
Vanguard	anilopyrimidine	-	-	++++	-	-	-	-	-	-
Scholar	phenylpyrrole	-	-	-	-	-	-	-	+++++	++++
Pristine	QoI and carboxamide	-	-	+++++	++++	++++	-	-	+++++	++

## PEACH INSECTICIDE AND MITICIDE CLASSES, HUMAN EXPOSURE RISKS, FINISH AND EFFICACY

**RATINGS** (+++++ = excellent, ++++ = good, +++ = fair, ++ = poor, + = suppression, - = no benefit) See IPM Management Guide section for rates and particulars. These ratings are benchmarks, actual performance will vary.

<i>Common Name (IRAC #)</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>beta cyfluthrin (3)</i>	Baythroid XL	- promotes scale	++	+++++	++ - +++++	++++	++++	- promotes mites	+++
<i>bifenazate (25)</i>	Acramite	-	-	-	-	-	-	+++++	-
<i>buprofezin (16)</i>	Centaur	+++++	-	-	-	-	-	-	-
<i>carbaryl (1A)</i>	Sevin	- promotes scale	-	++++	+++	++	+++++	- promotes mites	-
<i>chlorpyrifos (1B)</i>	Chlorpyrifos Lorsban	+	+	-	++++	-	-	-	+++++
<i>clofentezine (10A)</i>	Apollo	-	-	-	-	-	-	+++++ ovicide	-
<i>cyfluthrin (3)</i>	Baythroid Renounce Tombstone	- promotes scale	++	++++	+++	+++	++++	- promotes mites	++
<i>cyfluthrin (3) + imidacloprid (4A)</i>	Leverage	- promotes scale	++	++++	+++	+++	++++	- promotes mites	++
<i>cyhexatin (12B)</i>	Vendex	-	-	-	-	-	-	++++	-
<i>diazinon (1B)</i>	Diazinon	+++	++	+++++	++	++	++++	-	+
<i>endosulfan (2A)</i>	Phaser Thiodan	+	++	++++	-	++++	++++	- promotes mites	++++
<i>esfenvalerate (3)</i>	Adjourn Asana	- promotes scale	++	+++++	++ - +++++	++++	++++	- promotes mites	+++
<i>formetanate (1A)</i>	Carzol	-	++++	-	-	++++	-	++++	-
<i>gamma cyhalothrin (3)</i>	Proaxis	- promotes scale	++	+++++	+++	++++	++++	- promotes mites	+
<i>hexythiazox (10B)</i>	Savey	-	-	-	-	-	-	+++++ ovicide	-
<i>horticultural oils</i>	miscellaneous	++++	-	-	-	-	-	++++	-

## PEACH INSECTICIDE AND MITICIDE CLASSES, HUMAN EXPOSURE RISKS, FINISH AND EFFICACY RATINGS (continued)

<i>Common Name (IRAC #)</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>imidacloprid (4A)</i>	Couraze Nuprid Pasada Provado	-	-	-	+	-	+++++	- promotes mites	-
<i>indoxacarb (22)</i>	Avaunt	-	-	++++	++++	++	-	-	+
<i>lambda cyhalothrin (3)</i>	Lambda-T Silencer Taiga Warrior	- promotes scale	++	+++++	+++	++++	++++	- promotes mites	+
<i>malathion (1B)</i>	Malathion	+	+	++	++	++	+	+	+
<i>methidathion (1B)</i>	Supracide	+++	-	-	-	-	-	++	+++
<i>methomyl (1A)</i>	Lannate	-	++++	++++	+	++	++++	- promotes mites	-
<i>permethrin (3)</i>	Ambush Pounce	- promotes scale	++	+++++	++	++++	++++	- promotes mites	+
<i>phosmet (1B)</i>	Imidan	++++	+	+++++	+++++	++++	+++++	-	+
<i>pyridaben (21)</i>	Nexter Pyramite	-	-	-	-	-	-	++++	-
<i>pyriproxyfen (7C)</i>	Esteem Knack	+++++	-	+++	-	-	-	-	++
<i>spinetoram (5)</i>	Delegate	-	++++	++++	+	-	-	-	+
<i>spinosad (5)</i>	SpinTor	-	++++	++	-	-	-	++	-
<i>spiroticlofen (23)</i>	Envidor	-	-	-	-	-	-	++++	-
<i>thiamethoxam (4A)</i>	Actara	+	-	+++	++++	-	-	-	-

## WEED RESPONSE TO HERBICIDES

Application Method <sup>1</sup>	Karmex, etc.		Chateau		Solicam		Sinbar		Prowl		oryzalin		simazine		oxlyflurofen		Matrix		Fusilade, Select <sup>+</sup>		MSMA		glyphosate		paraquat		2,4-D		clopyralid <sup>4</sup>		Poast		Aim			
	PRE		PRE		PRE		PRE		PRE		PRE		PRE		PRE/PDS		PDS		PDS		PDS		PDS		PDS		PDS		PDS		PDS		PDS			
Time of Year <sup>2</sup>	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F
<b>BIENNIAL AND PERENNIAL WEEDS</b>																																				
asters	F	G					F	G	P	P	P	P		G	F	F			P	P			G	E	F	F	F				P	P				
bahiagrass	P	P	P	P	P		P-F	P-F	P	P	P	P	P	P	P	P			F	P	F		F	F	F	F	P	P			F	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				
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				
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				
dogfennel	P	F	P	P		E	G	G	P	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				
johnsongrass	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P			G	P	F-G		F	G	F	P	P	P			G	F				
nutsedge	P	P	P	P	P-F		P-F	P-F	P	P	P	P	P	P	P	F	F	F			P	P	G		F	G	F	F	P				P	P		
plantains			G	G		G		F	P	P	P	P	P	G					P	P			E	E	F	F	G	G			P	P				
wild garlic/onion	P	P	P			G			P	P	P	P	P	P					P	P			G	G	F	F	G	G			P	P				
Application Method <sup>1</sup>	Karmex, etc.		Chateau		Solicam		Sinbar		Prowl		oryzalin		simazine		oxlyflurofen		Matrix		Fusilade, Select <sup>+</sup>		MSMA		glyphosate		paraquat		2,4-D		clopyralid <sup>4</sup>		Poast		Aim			
	PRE		PRE		PRE		PRE		PRE		PRE		PRE		PRE		PRE		PDS		PDS		PDS		PDS		PDS		PDS		PDS		PDS			
Time of Year <sup>2</sup>	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F
<b>ANNUAL GRASSES</b>																																				
barnyardgrass	G		G		G		G		G		G		G		F		G		G		G		E		G		P	P			G					
crabgrass	G		E		G-E		G		E		E		G		F		G		G		G		E		G		P	P			G					
crowfootgrass	G				G		G		E		E		G		F				G		G		E		G		P	P			G					
fall panicum	F		G		E		G		G		G		G				F		G		G		E		G		P	P			G					
goosegrass	G		E		E		G		E		E		G		F				G		G		E		G		P	P			G					
Johnsongrass (seedling)	F		G		G		G		G		G		P						E		G		E		E		P	P			E					
ryegrass, annual		G		F			F		F		F-G		G-E	P					G	G	F		G	G	F	G	P	P			E	E				
sandbur	G				G		G		G		E		G		P				G		G		E		G		P	P			G					
signalgrass, broadleaf	G		G		G		G		E		G		P		P				E		F		E		G		P	P			E					
Texas panicum	P		G		F		F		G		G		F		P				E		F		E		E		P	P			E					

## WEED RESPONSE TO HERBICIDES (continued)

	Karmex, etc.		Chateau		Solicam		Sinbar		Prowl		oryzalin		simazine		oxlyfluro- fen		Matrix		Fusilade, Select <sup>+</sup>		MSMA		glypho- sate		para- quat		2,4-D		clopyra- lid <sup>4</sup>		Poast		Aim		
Application Method <sup>1</sup>	PRE		PRE		PRE		PRE		PRE		PRE		PRE		PRE		PRE		PDS		PDS		PDS		PDS		PDS		PDS		PDS		PDS		
Time of Year <sup>2</sup>	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	S	F	
<b>ANNUAL BROADLEAF WEEDS</b>																																			
bristly starbur	G		G		F		E		P		P		F		F-G				F	P	F		G		F-G		G				P				
chickweed	G	G		E	E	E		E		G		G		G				G	P	P			G	G	F	G	F	F			P	P		P	
cocklebur	G		F		F		G		P		P		F		G		F		P	P	E		E		G		E	E	E		P		G		
crotalaria	G		P				G		P		P				E				P	P	G		E		G		G		G		P				
croton, tropic	G		E		E		G		P		P		F-G		E				P	P	F		E		F-G		G				P				
evening primrose		G	G	E			F	G	P		P			G-E	F	G			P	P			P-F	F	F	F-G	F	G			P	P		F	
Florida beggarweed	G		G		G		E		P		P		G		P				P		E		E		E		F				P				
Florida pusley	G		E		G		E		G		G		G		E				P		F		G		F <sup>3</sup>		F				P				
horseweed	F	G	G	G	G	G	G	G	P	P	P	P	P	G	P	F			P	P			G-E	G-E	F <sup>+</sup>	F	G		E	E	P	P			
jimsonweed	G		G		G		E		P		F		F-G		G				P		F		E		G		E		E		P		G		
lambsquarters	E		E		F		E		E		E		E		E				P		F		G		G		E				P		E		
morningglories	G		G-E		F-G		G-E		P		F		F-G		F-G		G		P		F		G		G		G				P		E		
pigweeds	G		E		F		E		G		G		F-G		E		E		P		F		G		G		G				P		E		
prickly lettuce		G			G		E	P	P	P	P	G	E		G				P	P			G	G	F	G	G	G	G	G	G	P	P		G
prickly sida (teaweed)	G		G		G-E		E		P		P		F-G		E				P		P		G	F	G	P	G					P			
purslane, common	E		E		E		E		E		E		E		E		E		P		F		E		G		E				P				
ragweed, common	E		E		G		E		P		P		G		E		F		P		F		G		G		E	E	G		P				
sicklepod	G				F		E		P		P-F		F-G		F		G		P		F		G		E		E		E		P				
wild radish	F-G	G	E	E	F	G	E	E	P	P	P	P	G	E	G-E	E		G	P	P			E	E	F	G	G	G			P	P			

<sup>1</sup> PRE = Pre-emergence; PDS = Post-emergence Directed Spray.

<sup>2</sup> S = Spring; F = Fall.

<sup>3</sup> Paraquat will control only the seedling stages of Florida pusley.

<sup>4</sup> 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 during or after mixing, application or any accidental exposure, stop work at once and take care of individuals who may have been poisoned. If pesticide is spilled on the skin, immediately wash the area thoroughly with large amounts of soap and water. If pesticide is in the eye, flush the eye for 15 minutes in running water. If pesticide is inhaled, move to open clean air. If pesticide is ingested, rinse out the mouth. Follow all label first aid directions. Give CPR if indicated. **Immediately contact your physician, local emergency room or poison control center (1-800-222-1212). Transport the victim to the closest medical care facility. Take the pesticide container or the label with you or have others search for the label and get it to the facility.** Do not allow container to contaminate other people or objects.

Failure to follow pesticide label precautions can be lethal, especially with overexposure to organophosphate or carbamate insecticides/nematicides. **Follow all label safety precautions. Be especially aware of proper hygiene during mixing and application. Ninety percent of occupational exposure is through the hands. Use neoprene or butyl rubber gloves. Rubber boots prevent acute exposure from spills and chronic exposure from accumulation of residues in materials of boots and shoes. The PPE on the pesticide label is not a suggestion - it is the legally required minimum protection.**

**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*; eye effects, corrosive; skin effects, corrosive. **Warning** means *one to two tablespoons can kill*; eye effects, corneal opacity and irritation reversible within 7 days; skin effects, severe irritation at 72 hours. **Caution III** means *one ounce to one pint to kill*; eye effects, no corneal opacity and irritation reversible within 7 days; skin effects, moderate irritation at 72 hours. In some cases **Caution** means *it takes more than a pint to kill*; no eye effects; and skin effects are mild or slight.

**CLASSIFICATION OF PESTICIDES** -- The Environmental Protection Agency (EPA) is directed by federal law to classify higher-risk pesticides as **Restricted Use**. Restricted Use pesticides may only be purchased and applied by licensed applicators or under their direct supervision. Lower risk pesticides are classified as "General Use." General Use pesticides may be purchased by the general public. All pesticides must be applied according to their label directions.

**PERSONAL PROTECTIVE EQUIPMENT** -- Personal protective equipment (PPE) must be used as noted on each label. Applicators must read labels and maintain a wardrobe of protective equipment for applicators and handlers of pesticides. PPE requirements may change as a result of reregistration of the product. 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 or uses are deleted and added.

**ENDANGERED SPECIES ACT (ESA)** -- The ESA is enforced by the EPA. This act prohibits the use of certain pesticides in designated locations where 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 pesticide dealers, USDA-NRCS (Natural Resources Conservation Service) and county Extension offices.

**WORKER PROTECTION STANDARD (WPS)** -- The WPS applies to agricultural workers performing a variety of tasks. The WPS specifically covers 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 display information on pesticide applications at a central location during the Restricted Entry Interval (REI) and 30 days following the REI.

**RECORD KEEPING** -- Most states have a pesticide record keeping requirement. If they do not, there is a USDA federal pesticide record keeping requirement for Private Applicators. The federal requirement covers restricted use products only. However, record keeping is a prudent management tool which also provides risk and liability mitigation advantages that are potentially important to all edible crop producers. Check with your County Agent for state regulations.

**LICENSING OF APPLICATORS** -- All states have pesticide licensing or certification requirements. Restricted use products (RUP) may only be purchased and applied by licensed or certified applicators or persons under their direct supervision. Generally, there are categories of applicators, and a test must be passed to become a certified licensed applicator in the appropriate category. Once the test is passed, the applicator must be recertified periodically through continuing education credits/hours. Check with your County Agent for licensing and continuing education programs.

**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 your state landgrant institution's Pesticide Safety professional.

**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. Your state contact can provide publications that offer thoughtful guidance in preparing a pesticide storage site. There are no federal regulatory guidelines available, and most states have no regulatory statutes.

## 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.

**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 best control options. Dilute applications are ideally made 10-14 days apart. If scale is serious, fall applications applied during the first cool spell after full leaf drop is encouraged. In-season scale applications must be timed to coincide with crawler emergences to be effective. 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, Proaxis, Silencer or Sevin often promotes scale problems. Use scale-promoting insecticides on a strict as-needed basis – when REIs eliminate other more suitable alternatives.

**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 fungicide such as Indar or Elite 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, FlameOut) does not control brown rot, nor does Indar or Elite 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 DMI fungicides (Elite, Orius, Tebuzol, Indar, Nova, Orbit, Bumper, PropiMax) 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.

**Thrips** are damaging to nectarines, 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 nectarines 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 3<sup>rd</sup> 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 2 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.**

*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 1 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. **Then, before moth flight begins in mid- to late May, place in the upper third of trees 100 Isomate-M100™/acre for OFM (gives 90 days of control). A second application of Isomate M100™ may be needed by early August. Monitor for fruit damage weekly, especially around the edge of orchards where migrant females may lay fertile eggs. Apply insecticides to areas or blocks with damage.**

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	

ORIENTAL FRUIT MOTH DEGREE DAYS (45°F LOWER BASE) AT VARIOUS DAILY MAXIMUM AND MINIMUM TEMPERATURES																								
Max	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	92	94	96
Min																								
20	1	1	2	2	3	4	4	5	6	7	8	9	9	10	12	12	13	14	15	16	17	17	18	19
22	1	1	2	2	3	4	4	6	7	7	8	9	10	11	12	12	13	14	15	16	17	18	18	19
24	1	2	2	2	4	4	5	6	7	7	8	10	10	11	12	12	14	15	15	16	16	18	19	20
26	1	2	2	3	4	5	5	6	7	7	8	10	10	11	13	12	14	15	16	16	18	18	19	20
28	1	2	3	3	4	5	5	6	7	8	9	10	10	11	13	13	14	15	16	17	18	19	20	20
30	1	2	3	3	4	5	5	6	7	8	9	10	10	12	13	13	15	16	16	17	19	19	20	21
32	1	2	3	3	4	5	6	6	8	8	9	10	11	12	13	14	15	16	17	18	19	19	20	21
34	1	2	3	3	4	6	6	7	8	8	10	11	11	12	14	14	15	17	17	18	19	20	21	21
36	1	2	3	3	5	6	6	7	8	9	10	11	11	13	14	14	16	17	18	19	19	20	21	22
38	1	2	3	4	5	6	6	7	9	9	10	11	12	13	14	15	16	17	18	19	20	21	21	22
40	1	2	3	4	5	6	6	8	9	9	10	11	12	13	15	15	16	18	18	19	20	21	22	23
42	1	3	4	4	6	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
44	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
46	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
48	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
50	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
52	-	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
54	-	-	9	10	11	12	16	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
56	-	-	-	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
58	-	-	-	-	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
60	-	-	-	-	-	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
62	-	-	-	-	-	-	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
64	-	-	-	-	-	-	-	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
66	-	-	-	-	-	-	-	-	21	22	23	24	25	26	27	28	29	30	31	32	33	34	36	36
68	-	-	-	-	-	-	-	-	-	23	24	25	26	27	28	29	30	31	32	33	34	35	36	36
70	-	-	-	-	-	-	-	-	-	-	25	26	27	28	29	30	31	32	33	34	35	36	37	37
72	-	-	-	-	-	-	-	-	-	-	-	27	28	29	30	31	32	33	34	35	36	37	38	38
74	-	-	-	-	-	-	-	-	-	-	-	-	29	30	31	32	33	34	35	36	37	38	39	39
76	-	-	-	-	-	-	-	-	-	-	-	-	-	31	32	33	34	36	36	37	38	39	40	40

**Peach scab** is favored by cool, wet weather. Infection can take place from petal fall until 30 days pre-harvest. Shuck split through 2<sup>nd</sup> or 3<sup>rd</sup> 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 below. Adults emerge from 50 to 400 DD after biofix and damage occurs from 100 to 700 DD after biofix.

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 insults 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. DMI fungicides (such as Orbit, Elite, 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 benzimidazole, dicarboximide, DMI and QoI 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 DMIs 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 fungicide such as Indar or Elite as soon as possible after hail injury.** Note that propiconazole is not registered for use in cover sprays. Also, be aware that oxytetracycline (Mycoshield, FlameOut) does not control brown rot, nor does Indar or Elite control bacterial spot.

#### **‘Profile’, a science-based tool 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. ‘Profile’ was developed by Clemson University and University of Georgia scientists to manage existing and emerging fungicide resistance in the brown rot fungus. ‘Profile’ can identify the cheapest effective spray program for brown rot control for your operation based on your individualized resistance profile. In addition, Profile counteracts selection for fungicide resistance, making disease management and your operation more sustainable for the future.

‘Profile’ determines the sensitivity of the local *Monilinia* population to the most commonly used fungicide classes for brown rot management: the benzimidazoles (e.g., Topsin M), the demethylation inhibitors (e.g. Orbit), and the quinone outside inhibitors (e.g., Pristine). 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 grew on fungicide-amended medium, it would be considered resistant. The resistance profile may change from one season to another depending on the spray history.

Note that this service cannot be provided free of charge. 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 and Elite (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’ spring, 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. Fungicides for powdery mildew, in ascending order of efficacy include, sulfur, captan, Bravo and Nova.

**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 DMI fungicide (Nova) from shuck off through 3<sup>rd</sup> 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.

**Borers** are very serious tree pests. No effective controls are available for lesser peachtree borer in the Southeast. Peachtree borer treatment thresholds have not been developed, so annual, preventative barrier insecticides are recommended after harvest. See Post-Harvest borer section.

## 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 largely 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 the 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 southern peach growers. 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 or a small grain cover crop. 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/freeze 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 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, Stinger may be used as well. Stinger may be applied alone or tank mixed with 2,4-D.

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. Calibrate application equipment 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 21 days of application. Refer to product labels for preferred interval after application for activation. 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 can be found on product labels. Avoid applying herbicides to stressed weeds. Mowed weeds should be allowed to regrow 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.

## OFM in Newly Planted Orchards

Eliminating weed competition is essential for 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 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.**

## OFM 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, therefore 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 to 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, or glyphosate + 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 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 (Prowl 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 in Delaware, North Carolina, South Carolina, Georgia, and Tennessee. The two most notable species developing resistance to glyphosate are horseweed and Palmer amaranth. Glyphosate resistant ragweed is suspected and being investigated as well. Growers should be aware 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.

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. Scout orchards to identify weeds. Respond quickly to changes in weed population by controlling weeds before they spread throughout the entire orchard.
3. Use non-selective post-emergence herbicides in a weed management program.
4. Use herbicides only as-needed.

## HERBICIDE RECOMMENDATIONS

Use Stage and Herbicide	Broadcast Rate/Acre		Remarks and Precautions
	Amount of Formulation	Lbs Active Ingredient	
<b>Pre-emergence</b>			
<i>flumioxazin</i> Chateau 51WDG	6 to 12 ozs	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 Chateau (6 to 8 oz) is applied, followed by a second application when weed control from the initial application begins to fail. 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, Chateau can only be applied after final harvest up until bud break. Do not apply within 60 days of harvest. Chateau may be tank mixed with paraquat, glyphosate, or 2,4-D amine for post-emergence weed control.
<i>oryzalin</i> Surflan 4AS Oryzalin 4.0 lb/gal	2 - 4 qts	2 - 4	Use on non-bearing and bearing trees for control of annual grasses and small seeded broadleaf weeds. Use low rate for short-term control (2 to 4 months). <b>DO NOT</b> apply to newly transplanted trees until soil has settled and no cracks are present. Apply before annual weeds emerge in the spring or add paraquat for control of emerged weeds. May be tank mixed with Goal, paraquat, Princep, glyphosate or Solicam.
<i>pendimethalin</i> Prowl H2O 4.0 lb/gal	2 to 4 qts	2 - 4	<b>DO NOT</b> 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 preharvest interval for Prowl H <sub>2</sub> O in stone fruit is 60 days. Appropriate preemergence tank mix partners include simazine and Matrix FNV.
<i>terbacil</i> Sinbar 80 WP	0.5 to 1.0 lb	0.4 - 0.8	<b>THIS USE ONLY APPROVED FOR NEWLY PLANTED OR NON-BEARING ORCHARDS.</b> 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.
<i>diuron</i> Karmex, Diuron 80DF Karmex XP 80WDG	2 - 4 lbs (3 lbs max in GA) 2.0 to 2.75 lbs	1.6 - 3.2	Use for control of annual broadleaf weeds <b>ONLY</b> 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. <b>DO NOT</b> 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 has a 20-day PHI. Other diuron formulations have a 90 day PHI.
<i>simazine</i> Princep, Simazine 4L Princep, Simazine 90DG	2 - 4 qts 2.2 - 4.4 lbs	2 - 4	Use for control of annual broadleaf weeds <b>ONLY</b> 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. <b>DO NOT</b> apply to gravelly, sandy, or loamy sand soils. Add paraquat for control of emerged weeds.
<i>oryzalin</i> Surflan 4AS Oryzalin 4AS + <i>simazine</i> Princep, Simazine 4L Princep, Simazine 90DG	2 - 4 qts + 1.6 - 4 qts 1.75 - 4.4 lbs	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. <b>DO NOT</b> apply to gravelly, sandy, or loamy sand soils. Add paraquat or glyphosate for control of emerged weeds.
<i>rimsulfuron</i> Matrix FNV	4 oz	0.0625	Apply as a band or broadcast application. If applied as a broadcast application do not make more than one application per year. If less than 50% of the orchards floor is treated in the herbicide strip 2 applications may be used. <b>DO NOT</b> 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. Matrix has postemergence activity on certain weeds including henbit, common chickweed, horseweed, wild mustard, wild radish, and pigweed species. Matrix may be tank mixed with oryzalin, Solicam, diuron, Sinbar, glyphosate, or paraquat. Tree must be established for at least 1 year.
<i>terbacil</i> Sinbar 80W	2 - 3 lbs	1.6 - 2.4	Use for annual weed control and perennial broadleaf weed suppression. Use only under trees in <b>BEARING ORCHARDS</b> 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. <b>DO NOT</b> 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. <b>DO NOT</b> use on any soil with less than 1% organic matter.

## HERBICIDE RECOMMENDATIONS (continued)

Use Stage and Herbicide	Broadcast Rate/Acre		Remarks and Precautions
	Amount of Formulation	Lbs Active Ingredient	
<b>Pre-emergence (continued)</b>			
<i>diuron</i> Karmex, Diuron 80DF + <i>terbacil</i> Sinbar 80W	1 - 2 lbs + 1 - 2 lbs	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 2 years</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. <b>DO NOT</b> use on sandy, loamy sand, or gravelly soils or on eroded areas where subsoil or tree roots are exposed. DO NOT use on any soil with less than 1% organic matter.
<i>norflurazon</i> Solicam 80DF	2.5 - 5 lbs	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> Solicam 80DF + <i>simazine</i> Princep, Simazine 4L Princep, Simazine 90DG	2.5 - 5 lbs  1.6 - 4 qts 1.75 - 4.4 lbs	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> Solicam 80DF + <i>diuron</i> Karmex, Diuron 80DF	2.5 - 5 lbs  2.0 - 4.0 lbs (3 lbs 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>oxyfluorfen</i> Goal 2XL, Galigan 2 EC, GoalTender 4EC	5 - 8 pts 2.5 to 4 pts	1.25 - 2	Apply <b>ONLY</b> to DORMANT bearing and non-bearing trees for control of certain annual broadleaf weeds. <b>DO NOT</b> apply during the growing season or bud swell stage of growth. Has both contact post-emergence and residual activity. Use higher rates for pre-emergence treatments. May be tank mixed with simazine, Devrinol, Surflan, or paraquat.
<b>Post-emergence</b>			
<i>2,4-D amine</i> Various brands 3.8 lb/gal	2 - 3 pts	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. Research in NC indicates best results are achieved in winter, certainly before bud-break. Elimination of certain broadleaf weeds may reduce problems with mites and catfacing insects. DO NOT use on newly planted trees. DO NOT apply more than 2 times per season or within 2 weeks of bloom. Applications should be made when conditions do not favor drift. Some formulations may limit rate to 2 pts/acre.
<i>carfentrazone</i> Aim 2EC	0.5 to 2 ozs	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. Do not apply within 3 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 morningglory.
<i>clopyralid</i> Stinger or Clopyr AG 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.
<i>paraquat</i> Gramoxone Inteon 2.0 lb/gal Firestorm or Parazone 3.0 lb/gal	2.5 - 4.0 pts  1.75 - 2.7 pts	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. <b>DO NOT</b> 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.

## HERBICIDE RECOMMENDATIONS (continued)

Use Stage and Herbicide	Broadcast Rate/Acre		Remarks and Precautions
	Amount of Formulation	Lbs Active Ingredient	
<b>Post-emergence (continued)</b>			
<i>glyphosate</i> Various generic formulations 4.0 lb/gal Various Roundup formulations	0.5 - 2 qts  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>fluzifop</i> Fusilade DX 2.0 lb/gal	8 - 24 ozs	0.13 - 0.38	Use for control of annual and perennial grasses in <u>BEARING</u> 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.
MSMA 6.0 lb/gal	2 2/3 pts	2.1	For use in non-bearing orchards only. Provides POST control of bahiagrass, morningglory, sandbur, and suppression of nutsedge. Repeat applications at 14-day intervals may be necessary for bahiagrass control. Do not apply more than 3 applications per year. Do not contact bark or foliage. Some formulations require the addition of a surfactant. See labels for details.
<i>setoxydim</i> Poast 1.5 lb/gal	1.0 - 2.5 pts	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.
<i>clethodim</i> Select 2EC, Intensity 2EC, or Arrow 2EC Select Max or Intensity One	6 - 8 ozs  12 - 16 ozs	0.095 - 0.125	Use for control of annual and perennial grasses in <u>NON-BEARING</u> trees that will not be harvested within 1 year of application. 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. Does not control nutsedge(s). Sequential applications may 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 formulation is designed for use with a non-ionic surfactant.
<i>bentazon</i> Basagran	1.5 - 2 pts	0.75 - 1	Controls some broadleaf weeds and yellow nutsedge. For <u>NON-BEARING TREES ONLY</u> . A second application may be necessary to adequately control yellow nutsedge. Add crop oil concentrate (1 qt/acre).

## 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	1,3-dichloropropene Telone II	27-35 gallons	++++	5 days	4 to 8 weeks, longer when dissipation is slow.
<b>REMARKS:</b> Telone II is highly toxic. Carefully abide by all label precautions, and review the label before each application. <b>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.</b>					

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.

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.**

PEST(S)	MATERIAL(S)	RATE/ACRE	EFFECTIVENESS	REI/PHI	REMARKS
Ring nematodes Root-knot nematodes Root-lesion nematodes	<i>metam sodium</i> Vapam, Sectagon II, Busan 1020	75 gallons	+++	48 hours*	*In addition, if tarps are used for the application, non-handler entry is prohibited while tarps are being removed.  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.  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. <b>Plan for at least a 4-week interval between treatment and planting. More time may be required.</b>
Bacterial canker	<i>1,3-dichloropropene</i> Telone II	27-35 gallons	++++	5 days	4 to 8 weeks, 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.

## PEACH TREE SHORT LIFE MANAGEMENT

A key management tool in reducing loss from peach tree short life (PTSL) 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 oak root rot (*Armillaria tabescens*) and is still being evaluated for long-term orchard performance. Guardian, like Lovell and Nemaguard, is susceptible to *Pratylenchus vulnus* (root-lesion nematode).

## 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 apples and pears than in peaches. 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, \$2.27, to order call 828-864-3562 or <http://ipm.ncsu.edu/apple/orchardguide/contents.html>).

### 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 leaves 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 leave their sign. 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 might be considered.

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 apples 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*

**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.

### Exclusion

**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 apples 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. In addition to voles, hispid cotton rats (*Sigmodon hispidus*) may also be found. Outlined below is the geographic area in which each of these animals may be found.

Pine Vole<sup>1</sup>: Central Texas to Wisconsin & east to the Atlantic coast

Meadow Vole<sup>1</sup>: NC, SC, northern GA & TN (northeastern part)

Prairie Vole<sup>2</sup>: AL (northern third), TN (all except extreme east TN), MO, AR

Cotton Rat<sup>2</sup>: AL, GA, SC, NC (all except northeastern NC) & TN (all except north central TN)

<sup>1</sup>Johnson, 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 Johns Hopkins University Press, Baltimore, MD.

<sup>2</sup>Schwartz, 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.

**Cotton rats** average 10 inches in total length, including a 4-inch tail, which is scaly and sparsely haired. They have relatively large eyes and large ears that are almost hidden in blackish or grayish fur with rather stiff black guard hairs. They have four toes and a small thumb on the front feet and five toes on the hind feet.

### Habitat

Voles and cotton rats 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 (when in association with cotton rats, they favor the drier areas).

## 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. Cotton rats are very prolific and breed throughout the year. Several litters of up to 15 young may be produced annually. The gestation period is 27 days and the young are weaned in 10 to 15 days. The average lifespan of a cotton rat is about 6 months.

## 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. **Cotton rats** are nocturnal, but can be active during the day. They do not hibernate. Home range may be up to 1 1/4 acres for males. They swim readily. Cotton rats are most abundant in areas with thick, tall grass. Their nests are a crude mass of dry grass fibers stripped from larger plant stems and placed in shallow surface depressions, among clumps of coarse grasses, underground in shallow tunnels or under rocks or logs. Evidence of cotton rats includes the presence of stem and grass cuttings 2 to 3 inches long piled at various locations along 3- to 5-inch-wide runways. Pale greenish or yellow droppings about 3/8 inches long and 3/16 inches in diameter may be present along the runways.

## Damage and Damage Identification

**Meadow voles, prairie voles and cotton rats 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 and cotton rats 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/cotton rat 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, prairie voles and cotton rats) 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/cotton rat numbers. Maintain a 6-foot herbicide strip and keep the middles and orchard borders mowed close to lower vole/cotton rat numbers. Clearing up and mowing adjacent ditchbanks and grassy waterways also discourages voles.

<b>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.</b>	
zinc phosphides—ZP rodent Bait Ag, Ridall-zinc, Roban II, Zinc Phosphide Pellets—for use in all states	<p>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:</p> <ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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.</li> </ol>
diphacinone—Ramik Brown—GA, NC, SC, MO, VA	<p>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.</p> <p>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.</p>
chlorophacinone—Rozol “Rat and Mouse Killer Pellets”, Rozol Ground Spray—NC	<p>Rozol Parafinized Pellets is a 0.005% bait for hand placement in vole runs at the rate of 10 pounds per acre or for broadcast to vegetation under and around trees with a mechanical spreader. Rozol is a continuous feed anticoagulant.</p> <p>Rozol ground spray is formulated as a 5.34% EC and is used as a ground spray at one pint per 100 gallons and 600 gallons of spray per treated acre. It is an anticoagulant and has a safety code of D.</p>

### 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 midafternoon, 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, do not rely on repeat applications of zinc phosphide in 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.

**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

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

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 elevation of 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 CO<sub>2</sub> 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<sup>+</sup>) and hydroxide (OH<sup>-</sup>) 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 which 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	Provado	7.5	> 31 days			
formetanate hydrochloride	Carzol	5.0			4 hours above pH 7	
pyridaben	Nexter	stable from pH 4 to 9				
<b>phosmet</b>	<b>Imidan</b>	<b>5.0</b>		<b>12 hours</b>	<b>4 hours</b>	
chlorpyrifos	Lorsban			35 days	22 days	
carbaryl	Sevin			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			
<b>captan</b>	<b>Captan</b>			<b>8 hours</b>	<b>10 minutes</b>	
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.

### 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.

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 lbs/100 gals	24 hrs/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	Ferbam Granuflo  plus dormant oil or dormant oil plus chlorpyrifos 4E	4.5 lbs  1-2 gals 1.5-3 gals 1-2 pts	24 hrs/21 day  12 hrs/not recommended after bloom  4 days/recommended for post-harvest use only	If orchards were not sprayed the previous season, apply Ferbam between 95% leaf drop and budswell. 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).  Adjust oil down as buds swell and begin to break. Apply no more than 1.5 gals oil per acre, no later than first budbreak. Two applications 7 to 10 days apart are most effective for scale. Thorough coverage, to near the point of run-off, enhances control.
May or June	Scab Scales Oriental fruit moth Shothole borers	sulfur 80% plus  chlorpyrifos 4E	9-12 lbs  3 pts	24 hrs/0 days  4 days/recommended for post-harvest use only	
August or September	Borers	chlorpyrifos 4E	3 pts	4 days/recommended for post-harvest use only	Apply chlorpyrifos from early August to late September with a handgun, effectively drenching young trees.

## 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

Nitrogen is needed annually. Potassium application is based on cropping history and soil and foliar analysis. Other plant nutrients may or may not be required, based on analysis. Rates given are intended as general guidelines. Base actual rates on soil and leaf analysis, irrigation practices, variety, and visual indicators such as fruit yield and quality, leaf color and terminal shoot growth.

**NITROGEN**—Split nitrogen applications typically improve fruit quality and minimize excess vigor. Apply: 1) one-half post-harvest; 2) remainder in late winter prior to bud break. Nitrate nitrogen (versus ammonium or urea) is most desirable.

- 1) **POST-HARVEST, BUT NOT LATER THAN MID-SEPTEMBER** - Apply 20 to 50 lbs of nitrogen per acre in the herbicide band. Late season nitrogen helps build reserves accumulated in the fall which are responsible for following spring's bud and bloom growth.
- 2) **LATE WINTER BEFORE AND UP TO BUD BREAK** - Apply 30 to 60 lbs of nitrogen per acre in herbicide band. Early timing for extreme south Georgia. Excessive nitrogen invigorates excessive shoot growth, decreases red color development, delays maturity and does not increase fruit size.

**POTASSIUM**—Once adequate soil levels are established, addition of 60-80 lbs of K<sub>2</sub>O per acre annually (or equivalent amount of potassium sulfate) should maintain levels in orchards with normal crop levels. Potassium chloride (muriate) should be avoided when large quantities of potassium are required.

### 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

	Year 1	Year 2
March	Broadcast 1 lb of 10-10-10 over a 4-5' diameter circle.	Broadcast 2 lb of 10-10-10 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.

## 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 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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J. Scott Angle, Dean and Director