

INSECT AND DISEASE MANAGEMENT FOR HOME-GROWN FRUITS AND NUTS

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The following schedules are to be used by those who will observe all label precautions, treatment recommendations and protective clothing guidelines. These pest management suggestions, whether cultural or chemical, are not effective unless completed in a timely fashion on a regular schedule. Modern crop protection materials are designed to break down to natural elements over time to protect consumer and environment. Pre Harvest Interval (PHI) and restricted entry interval (REI) are provided to protect the consumer from exposure to crop protection materials and to prevent individuals not wearing protective equipment from entering treated areas until it is safe. Do not eat fruit until the pre harvest interval is over. Crop protection materials are listed in form of active ingredients. The same active ingredient may be sold under different trade names and from different companies. Always read the label before applying the product. The site or crop where the pest is to be controlled must be on the label. Most

products are available in small packages. In some cases generic compounds, available in large packages, are legal to use in the home situation. The pest management schedules are prepared according to plant growth stages. Various insects and diseases attack each stage of development. The proper materials to use are listed in the second column entitled “Materials To Use: Fungicides and Insecticides”. The fungicides are listed first followed by the insecticides or miticides. The disease(s) controlled by a fungicide are listed first in the next column (**To Control**) followed by the insects or mites. The amount used per volume of water sprayed is listed on the brand or trade label. Do not use more than the label recommended amount of the pesticide because of excess residues, possible toxicity to the plants or damage to the environment.

APPLES AND PEARS			
Disease resistant apple varieties can reduce the need for chemical products. Varieties to consider include Goldrush, Enterprise, Pristine, Gala Supreme, Liberty, Freedom, and Jonafree for scab resistance and Pristine, Sunrise, Arlet, Enterprise, for sooty blotch and fly speck resistance.			
Time of Application	Materials To Use:* Fungicides and Insecticides	To Control	Remarks
DORMANT Prior to bud swell	NO FUNGICIDE ----- Summer or superior oil	Scab, fruit rots ----- Mites and scales	Prune trees regularly but lightly to maintain open canopy; remove dead branches. Rake and destroy tree residue. Two applications are best, 3 weeks and 1 week before bud swell.
DELAYED DORMANT When leaves are ½ to ¾ inch long.	Captan or mancozeb ----- NO INSECTICIDES	Scab, powdery mildew and black rot.	Bordeaux and Lime sulfur, are not compatible with other insecticides and fungicides.

Time of Application	Materials To Use:* Fungicides and Insecticides	To Control	Remarks
<p>PREPINK First pink color in the flower buds</p>	<p>Fungicides same as delayed dormant PLUS Superior type spray oil plus Bacillus thuringiensis</p>	<p>Scab, powdery mildew, rust and black rot ----- Aphids, mites, caterpillars</p>	<p>Use oil at ¼ to ½ the normal rate. Where oil is used for aphids do not use captan for 2 weeks for scab control. Oil will enhance activity of thiophanate-methyl. Bacillus thuringiensis is for caterpillar control</p>
<p>PINK When flowers have separated just before bloom.</p>	<p>Fungicides same as Delayed Dormant ----- NO INSECTICIDE-PROTECT BEES</p>	<p>Scab, black rot, frog-eye, powdery mildew, rust</p>	<p>Where scouting indicates aphids and caterpillars are still a problem oil and B. thuringiensis may be re-applied.</p>
<p>BLOOM When 70-80% flowers are open.</p>	<p>NO FUNGICIDES Use streptomycin ----- NO INSECTICIDES- PROTECT BEES</p>	<p>Fire Blight</p>	<p>If fire blight is not a problem, this spray can be omitted. Where fire blight is severe, copper hydroxide may be used in dormant to silver tip spray but bloom sprays are still required.</p>
<p>PETAL FALL When 60-70% petals have fallen</p>	<p>Captan and/or thiophanate-methyl PLUS Highly refined summer oil plus Bacillus thuringiensis or sulfur plus B. thuringiensis</p>	<p>Scab, black rot, frog-eye, mildew, rust ----- Aphids, mites, caterpillars, curculios</p>	<p>On pears, additional applications of streptomycin are suggested for First Cover. Pears are more tolerant of Bordeaux but on apples expect poor fruit finish. ----- Where plum curculio is present a professional applicator is required. Do not use carbaryl (Sevin) as it causes fruit thinning</p>
<p>FIRST THROUGH FIFTH COVER SPRAY** First 10 days after petal fall, second through fifth at 14-day intervals thereafter.</p>	<p>Rotate captan, sulfur plus thiophanate-methyl, and sulfur plus myclobutanil PLUS ----- carbaryl plus Insecticidal Soap (second and forth cover if mites are a problem.</p>	<p>Scab, mildew, black rot, white rot, bitter rot ----- Aphids, scales, leafhoppers, Japanese beetles, curculio, apple maggot, catfacing insect. Mites</p>	<p>Thorough coverage of whole tree and maintaining protective covering are important. ----- Use of Sevin within 30 days after bloom will cause thinning of apples. Regular use of Sevin may result in increased mite problems.</p>

Time of Application	Materials To Use:* Fungicides and Insecticides	To Control	Remarks
<p>SIXTH AND SEVENTH COVER SPRAY** Two-week intervals (early maturing varieties may not require these additional cover sprays; late maturing varieties may require more than the seven indicated here).</p>	<p>Captan and or thiophanate-methyl PLUS carbaryl</p>	<p>Sooty blotch, fly speck, bitter rot, and white rot ----- Catfacing insects, apple maggots</p>	<p>Do not use thiophanate-methyl within 1 day of harvest ----- Do not apply carbaryl within 3 days of harvest.</p>
<p>BRAMBLES-Blackberries, Dewberries</p> <p>Cultivar selection is important to avoid disease and insect problems. Arapaho, Navaho and Apache are resistant to double blossom, anthracnose and the blackberry psyllid. Navaho is susceptible to orange rust. Chester, latest maturing, is resistant to double blossom but susceptible to psyllid. Choctaw, earliest maturing, is 60% resistant to double blossom, susceptible to psyllids but very susceptible to mites. Destruction of prunings and nearby brambles reduces the need to spray.</p>			
<p>DELAYED DORMANT As bud begins to break.</p>	<p>Copper oxychloride or coppersalts of fatty acids or lime sulfur ----- NO INSECTICIDE</p>	<p>Anthracnose -----</p>	<p>Good thinning, mulching and pruning should eliminate need for this spray; Womack, Raven Brison, Brazos, and Rosborough are susceptible</p>
<p>NEW CANE New can 6-12 inches high</p>	<p>Same as Delayed dormant ----- NO INSECTICIDE</p>	<p>Anthracnose</p>	<p>Do not apply once bloom begins</p>
<p>PREBLOSSOM Just before blossoms open</p>	<p>Copper salts of fatty acids PLUS Carbaryl or malathion or insecticidal soap</p>	<p>Same as above plus rust and double blossom (rosette) ----- Thrips, mites, strawberry weevil/clipper, psyllid</p>	<p>Immediately remove by digging any new canes showing any orange rust spores on undersides of leaves. Removing rosettes of double blossoms will aid in control. ----- Pine trees at ½ mile distant are less of a threat for psyllid. Increased berry size will compensate some for flowers destroyed by the strawberry weevil. Carbaryl will flare mites on Choctaw variety.</p>

Time of Application	Materials To Use:* Fungicides and Insecticides	To Control	Remarks
<p>AFTER BLOSSOM AND UNTIL HARVEST</p> <p>At 10-14 day intervals</p>	<p>Same as new cane PLUS carbaryl</p>	<p>Septoria and double/blossom ----- Japanese beetle, sawflies</p>	<p>An alternate way to control double blossom without spraying, in erect blackberries varieties only, is to cut all canes down immediately after harvest and regrow new canes by fall. ----- Use carbaryl as needed for control. Do not apply within 7 days of harvest.</p>
<p>MID FALL</p>	<p>malathion</p>	<p>Raspberry crown borer</p>	<p>This borer will destroy a blackberry planting. Scout for lethargic yellow jacket like moth. When found drench base of canes with malathion solution. Remove and destroy infested canes</p>
<p>GRAPES</p>			
<p>There are three types of grapes grown in the region. Labrusca (concord types), vinifera and hybrids (wine grapes) and muscadines. The diseases to be managed depend on the type grown: Angular leaf spot (muscadine), Anthracnose (concord and some wine grapes), black rot (all three), bitter rot (muscadine), ripe rot (mostly muscadine), Botrytis (wine grapes), downy mildew (concord and wine grapes), Macrophoma rot (muscadine), Phomopsis cane and leaf spot (wine grapes), dead arm (all three) and Pierces’s disease (mostly concord and wine grapes). It is important identify the disease before making the decision on which materials to use below. Your spray volume should increase as the season progresses. If your first spray takes 1 gallon your last post bloom should take 3-4 gallons.</p>			
<p>NEW SHOOT SPRAYS</p> <p>When shoot is ½ inch long When shoot is 6-12 inches long</p>	<p>mancozeb , basic copper sulfate, copper hydroxide, copper salts of fatty acids, or myclobutanil ----- NO INSECTICIDE</p>	<p>Black rot, anthracnose, angular leaf spot, phomopsis</p>	<p>Copper materials can be phytotoxic under poor drying conditions. Myclobutanil for black rot and angular leaf spot. Mancozeb is for black rot and anthracnose.</p>
<p>PREBLOOM</p> <p>Just before blossoms open</p>	<p>Same fungicides as in New Shoot Sprays PLUS carbaryl , malathion or Bacillus thuringiensis</p>	<p>Same as above ----- Berry moth, leafhopper, colaspis, grape leaf folder</p>	<p>Important black rot spray. On vinifera type grapes use mancozeb. do not apply coppers during bloom. ----- Thorough coverage necessary for control. Use Bacillus thuringiensis for grape berry moth and grape leaf folder. Do not apply malathion less than 3 days before harvest.</p>

Time of Application	Materials To Use:* Fungicides and Insecticides	To Control	Remarks
<p>POSTBLOOM SPRAYS Just after blooms fall and then every 10-14 days for two sprays</p>	<p>Mancozeb, captan, myclobutanil, triadimefon and copper materials in new shoot spray PLUS Same as Prebloom</p>	<p>Downy mildew, powdery mildew, angular leaf spot, black rot, bitter rot, ripe rot, botrytis ----- Same as Prebloom plus Japanese beetle, June beetle wasps</p>	<p>Mancozeb is for downy mildew, black rot and ripe rot. Captan is for botrytis and ripe rot. Myclobutanil for powdery mildew black rot and bitter rot. Triadimefon is for powdery mildew and black rot. ----- Do not use malathion within 3 days of harvest and carbaryl within 7 days of harvest.</p>
<p>THIRD POSTBLOOM SPRAY TILL HARVEST Continuing at 10-14 day intervals until harvest</p>	<p>captan and/or myclobutanil or copper fungicides in new shoot spray PLUS Same as Prebloom</p>	<p>Same as above plus macrophoma rot ----- Same as Prebloom</p>	<p>Captan is the preferred material on all types and may be used through harvest. It also controls bitter rot and macrophoma rot. Do not use mancozeb within 66 days of harvest or myclobutanil within 14 days and triadimefon within 45 days of harvest</p>
<p>STEM BORER (Anytime of year) GRAPE ROOT BORERS</p>	<p>NO INSECTICIDES ----- NO INSECTICIDES</p>	<p>Borers in vines (Laterals on wire) ----- Mound approximately July 14-21</p>	<p>Prune infested vines and burn. ----- Mound soil 10-12 inches around base of vine. Remove mound between November and February.</p>
<p>After bloom sprays are completed, the bunch grapes can be covered immediately with a 5-pound paper sack to protect from diseases and insects. This will eliminate the need for further sprays, but foliage diseases may make vines unsightly.</p>			
<p style="text-align: center;">NECTARINES, PEACHES AND PLUMS</p> <p>The key to disease and insect control in stone fruits is strict sanitation. Remove and destroy all dead and dying branches. Fertilize each year. Remove all fallen fruit from under tree. If on sandy soil select cultivars resistant to bacterial spot. Use Guardian rootstock to improve tree life. Avoid oak root rot sites. Where crown gall is a problem use Agrobacterium radiobacter strain 84 or 1026</p>			
<p>DORMANT Prior to bud swell</p>	<p>Chlorothalonil or copper hydroxide, or copper salts of fatty acids -----PLUS----- Summer or superior oil (2-3 % actual oil)</p>	<p>Peach leaf curl ----- Mites, scales</p>	<p>If peach leaf curl is a problem, apply fungicide anytime during the dormant period from leaf drop to bud swell. ----- Follow manufacturer's recommendations. Two applications are best, 3 weeks and 1 week before bud swell.</p>

Time of Application	Materials To Use:* Fungicides and Insecticides	To Control	Remarks
<p>BLOSSOM SPRAY (2) Just before first blooms open and in full bloom.</p>	<p>captan , thiophanate-methyl or chlorothalonil -----PLUS----- NO INSECTICIDES-PROTECT BEES</p>	<p>Brown rot blossoms blight, botrytis flower blight</p>	<p>Prune out any branches that show symptoms of wilting or flagging.</p>
<p>PETAL FALL THROUGH THIRD COVER SPRAY** After petals fall off</p>	<p>captan , or high rates of sulfur PLUS carbaryl or malathion</p>	<p>Scab, brown rot, powdery mildew ----- Catfacing insects, curculio, aphids</p>	<p>Use captan plus thiophanate-methyl captan plus myclobutanil where blossom blight is observed. Resistance to thiophanate-methyl is a threat. First and second cover are critical for scab control. ----- Carbaryl will flare mites. Peaches are quite tolerant of mites. Summer oil (1/2%) may be used to suppress mites but do not use within 2 weeks of captan spray or within 7 days of harvest. Malathion will control aphids; do not use within 3 days of harvest.</p>
<p>FOURTH COVER SPRAY THROUGH SEVENTH COVER SPRAY**</p>	<p>captan or high rates of sulfur PLUS Insecticides same as above</p>	<p>Scab ----- Insecticides same as above</p>	<p>These sprays may be omitted if no problems are encountered. If fruit is damaged by hail, insects, etc., resume application. ----- Carbaryl may be applied until 7 days before harvest and malathion within 3 days</p>
<p>PREHARVEST Two to three applications 21, 14 and 7 days before harvest</p>	<p>Rotate captan plus thiophanate-methyl and myclobutanil ----- NO INSECTICIDES</p>	<p>Brown rot, rhizopus (Mr. Whiskers)</p>	<p>Start sprays with the first tinge of color. Do not apply captan or thiophanate-methyl within 1 day of harvest. Remove and destroy all diseased fruit as soon as they are observed.</p>
<p>POSTHARVEST</p>	<p>None available</p>	<p>Peachtree borers</p>	<p>Carefully excavate around tree crown, washing away gum and stick wire</p>

			down borer tunnels.
BLUEBERRIES			
Blueberries are easily grown in the home garden without crop protection materials. Rogue wild blueberries for ¼ mile, be prepared to net and/or install constantly moving shiny reflectors to protect from bird depredation. Avoid sites near woods or other ericaceous plants to avoid pine voles. Critical problems requiring action are mummy berry and cranberry fruit worm.			
Time of Application	Materials To Use:* Fungicides and Insecticides	To Control	Remarks
DELAYED DORMANT Buds ¼ to ½ inch green	NO FUNGICIDES ----- Summer or superior oil (2 or 3% actual oil)	----- Scales	Generally scales are not a problem unless excessive insecticides are used. Follow manufacturer's recommendations
GREEN TIP + BLOOM SPRAYS When new shoots just begin to emerge continuing through bloom	captan ----- NO INSECTICIDE	Mummy berry, Botrytis -----	Thoroughly clean mummies from under bush or use 2 inch of ground bark mulch to cover mummies. Select elevated sites [hilltops] to avoid late frosts, which may increase Botrytis.
PETAL FALL When 60-70% of the petals have fallen	captan PLUS malathion	Leaf spots, stem blight, and Botrytis ----- Cranberry and cherry fruit worms, weevils	Botrytis most likely after a frost. ----- Timing sprays is important in insect control. Thorough coverage is necessary. Do not apply malathion less than 1 day from harvest
COVER SPRAY** Ten days after petal fall for three applications at 10-14 day intervals	captan PLUS Malathion or carbaryl	Leaf spots, stem blight, fruit rot ----- Maggots	After the 5 th year prune regularly in winter to maintain vigor and remove dead and dying twigs which harbor leaf spot and stem blight fungi ----- Blueberry maggot is rare but does occur in SC. Scout before deciding to treat with insecticides. Do not use carbaryl within 7 days of harvest.
<i>Oberea</i> Stem borer. Break or cut out oberea girdled shoots. Do not treat oberea with insecticides. Removal will reduce chances of stem blight disease.			
HARVEST SPRAYS	NO FUNGICIDES ----- Malathion or carbaryl	Japanese and June beetle adults, plant bugs	Carbaryl may be used up to 7 days before harvest and malathion within 1 day of harvest.

STRAWBERRIES

Strawberries are grown in 2 different cultural systems, matted row and annual hill culture (commercial farms). Matted row is suggested for home use. Annual hill culture varieties do not perform well because of extreme susceptibility to various leaf diseases. Varieties such as Earliglow and Apollo perform well in matted row culture and have tolerance to diseases. In matted row culture, the planting is renovated in June. In annual hill culture the plants are removed from the plastic covered bed in June, sometimes double cropped with peppers, tomatoes or squash. The plastic is removed late August, new bed fumigated and covered with plastic with new plants (Chandler, Camarosa, Sweet Charlie, or others) installed in early October. Sanitation (removing dead/dying leaves by hand) prior to when flower buds become visible in the crown can greatly reduce Botrytis incidence. Matted row plantings can persist 3 to 10 years but are best rotated to new sites after 5 or so years to avoid root weevils and grubs destroying the root systems.

Time of Application	Materials To Use:* Fungicides and Insecticides	To Control	Remarks
WHEN BLOSSOM BUDS VISIBLE IN CROWN	captan , Bordeaux, copper hydroxide, or copper salts of fatty acid PLUS malathion or carbaryl or insecticidal soap	Foliage disease and Botrytis ----- Aphids, flea beetles, tarnish plant, bug root weevil, leaf rollers	Mulching of plants during the late dormant season is essential for fruit rot control. Mulch too early and slugs will be a problem. Where copper is selected apply under good drying conditions. Phytotoxicity possible. ----- Insecticidal soap for aphids. Other wise use malathion. Carbaryl will flare mites.
PREBLOOM When flowers have pushed out of crown.	Same as above PLUS Same as above	Foliage disease, fruit rot, Botrytis, greymold ----- Same as above	Controlling disease during bloom is essential for later fruit rot control. ----- Do not apply malathion within 3 days; carbaryl within 7 days of harvest;
BLOOM When flowers are open	captan ----- NO INSECTICIDES	Same as above -----	Coverage is important, especially during bloom and while berries are developing. Remove dead flowers and leaves from field to reduce disease pressure. ----- To protect bees, do not apply insecticides at this time
TEN DAYS AFTER BLOOM UNTIL HARVEST (at 5-7 day intervals)	Same as bloom PLUS	Same as above -----	It is generally 35 days from bloom till harvest. Focus sprays on blooms. Green fruit are somewhat resistant to Botrytis. Remove dead flowers and

	Metaldehyde bait Insecticidal soap	Slugs, snails, aphids	leaves. ----- Mulch just prior to green fruit touching the ground. Insecticidal soap for aphids.
Time of Application	Materials To Use:* Fungicides and Insecticides	To Control	Remarks
HARVEST (at 5-7 day intervals)	captan PLUS NO INSECTICIDES	Botrytis, fruit rot, greymold	As fruit matures it becomes susceptible to Botrytis. If Botrytis is present full coverage spray of fruit is required to reduce disease.
RENOVATION OF MATTED ROW – Immediately after final harvest, usually early mid June. Remove tops with rotary mower set high so as not damage crowns. Incorporate by tilling alternate half of the row each year. Fertilize to promote new runner plants. Allow for re-growth of broad leaf weeds then spray with 2,4 D herbicide before mother plant new leaf emergence and/or cultivate by hand till new canopy is fully developed.			
POST RENOVATION (at 10 –14 day intervals as required)	Copper hydroxide or copper salts of fatty acids	Leaf spots	Poorly adapted varieties may benefit from leaf spot control. These sprays are usually not warranted.
PECANS			
Selecting resistant cultivars is important for home pecan plantings. Stuart is an old reliable variety. Since the flowers are diecious it is necessary to have a second variety. Beneficial lady bugs and lacewings suppress aphid and mite populations. Elimination of early season insecticides conserves beneficial insects. Early season legumes such as crimson clover and hairy vetch promote these beneficial insects. Pecan trees are difficult for homeowners to spray because of height. Garden hose proportioners will treat to 20 or 30 feet depending on pressure and eliminate diseases, such as downy spot, which carry over in fallen leaves. Raking and destroying leaves also helps.			
WHEN LEAVES FIRST SHOW GREEN (Approximately April 12) AND AGAIN WHEN HALF GROWN	Thiophanate-methyl PLUS malathion	Scab, downy spot ----- Nut casebearers, spittlebug, aphids	Thorough coverage of whole tree is important. Avoid use of insecticides unless demonstrated problem with case bears and spittlebugs is present. Malathion can be applied up to the day of harvest.
FIRST COVER THROUGH SIXTH COVER SPRAYS** Until shucks around nut begin to split at 2-to-3 week intervals (first cover about April 26)	Thiophanate-methyl PLUS malathion carbaryl	Scab, downy spot, brown leaf spot, powdery mildew ----- Nut casebearers, spittlebug, aphids, weevil, shuckworms	Zinc chelate can be added to second or third cover to control rosette. Clean up and destroy early drops to reduce second generation shuck worm populations. Do not apply carbaryl within 14 days of harvest.

PECAN WEEVIL - methods to suppress adult pecan weevil populations include sticky traps on tree trunks or soil surface applications of carbaryl during August and September, especially before heavy rains provide for heavy emergence. Apply 2.5 to 3.5 ounces (15 to 22 level tablespoons) of carbaryl 80% Sprayable per tree, to soil under the tree, in enough water (10 gallons/tree minimum) to uniformly cover the entire area beneath tree canopy to 10 feet beyond dripline. Start applications 7-10 days after shell hardening (August 1-10) until adult weevils are not present (September 15).
 SHUCK DISORDERS – have diagnosis of shuck rot or anthracnose confirmed before using fungicides indicated here. Start when the tip of the nut turns brown and add copper hydroxide to the cover sprays. Phytotoxicity is possible under poor drying conditions.

HARVEST	None ----- None	Aflatoxins -----	Do not allow nuts to lie on ground. Shake from tree; pick up and store in cool, dry place immediately.
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CHERRIES (Sweet or Tart)

Many cherry varieties are not adapted to South Carolina. Cracking is the biggest problem with sweet cherries as well as bacterial canker. Consult Circular 477 for varieties for South Carolina, but in local experiments Hedelfingen, Blackgold and Vandalay have performed satisfactory. These varieties will pollinate each other. As for Sour Cherries, Montmorency has done very well. Where soils are poorly drained select Mazzard, Stockton, Morello or Colt root stocks. Otherwise Mahaleb may be used.

Time of Application	Materials To Use:* Fungicides and Insecticides	To Control	Remarks
DELAYED DORMANT When terminal leaf buds show ¼ inch green prior to bud swell	chlorothalonil PLUS Summer or superior oil (2-3 % Actual oil)	Leaf spot, leaf curl ----- Mites, scales	Clean up and destroy fallen leaves. ----- Two applications. Three weeks and one week before bud swell. Follow manufacturer’s recommendations.
BLOOM SPRAY(S)	Thiophanate-methyl, chlorothalonil, captan, ammonical copper, or basic copper sulfate ----- NO INSECTICIDES PROTECT BEES	Leaf spot, brown rot, Botrytis flower blight -----	This spray should be applied as soon as leaves begin to unfurl. If bloom is delayed, two applications may be necessary.
PETAL FALL When about ¾ of the petals have fallen through SECOND COVER** (three sprays at 10-to 14-day intervals.	Thiophanate-methyl plus sulfur PLUS carbaryl or malathion	Leaf spot, powdery mildew ----- Catfacing, aphids, curculio, Japanese beetles, caterpillars	Where leaf spot is not a problem use sulfur. ----- Carbaryl and malathion may be applied until 3 days from harvest.
PREHARVEST When fruit begins to color –two sprays at 7- to 10-day intervals	Rotate captan plus myclobutanil with captan plus thiophanate-methyl PLUS Insecticides same as PETAL FALL	Leaf spot, brown rot, powdery mildew ----- Catfacing, aphids, curculio, Japanese beetles, caterpillars	In a dry year, you may choose to not use captan. Thorough coverage is important. -----

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POSTHARVEST	Ammonical copper, basic copper sulfate or chlorothalonil PLUS carbaryl or malathion ----- NONE AVAILABLE	Leaf spot ----- Foliage-feeding caterpillars ----- Peachtree borers	Apply as necessary to keep trees from being defoliated. Severe defoliation from leaf spot may result in death of tree ----- Examine tree annually in the fall by excavating around the trunk and destroying borers by hand.
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*Spray all fruits to the point of runoff.

**“Cover sprays” refer to the regular application of pesticides to prevent infection or infestation. They begin 10 days after petal fall and are applied at 10 to 14-day intervals where required.

APPLE INSECTS

Aphids: Two species of aphids can cause problems with tree production:

(1) Rosy Apple Aphids: This pink-bodied aphid causes severe puckering and knotting of the fruit. Infestations may be noted by the curling and wrinkling of leaves near young apples. **(2) Woolly Apple Aphid:** This aphid affects the root systems primarily but may be found in cracks and wounds on the upper portions of the trees. They produce a white waxy mass over their reddish-purple bodies and are readily noted. On the roots they cause galling and an increased number of secondary roots, which stunt the tree and reduce production.

Codling moth: Damage by this pest is usually recognized as a hole bored into the side or blossom end of the fruit with a pile of frass webbed together and dangling from the opening. This pest completely destroys the infested fruit. It is a pinkish-white caterpillar with a brown head. At maturity the caterpillar leaves the apple and falls to the ground or climbs to the trunk of the tree to pupate, overwintering in this condition.

Curculio: Injury is shown by small crescent-shaped cuts in the skins of small fruits with a small hole at one end into which the egg is deposited. Depressions usually develop at such sights. Examination reveals a grayish-white grub inside. Infested fruits fall prematurely and are usually hard, knotty and misshapen.

Mites: Two species are usually injurious to apple foliage: the two-spotted mite and the European red mite, they produce a stippling of the leaves by puncturing the cells of the leaf and sucking out the juices. Silk webbing over the infested area is also common. It also helps to explain the origin of their name spider mites. The two-spotted mite may be green or orange in color, depending on host and time of year, with two large dark spots on the sides of the abdomen. The European red mite is dark red with stiff hairs on its back and tan legs. A hand lens is required for good observation of these pests.

Catfacing insects: Several species of plant bugs and stink bugs are included in this category. The adults inject toxic saliva while feeding on the developing fruit buds and young fruit. These feeding punctures can cause the fruit to become deformed. Damaged areas are more or less conical depressions in the fruit with corky tissue at the bottom. The adults often move onto the trees from nearby fields and weedy areas.

APPLE DISEASES

SPRING

Scab: This first shows as an olive green spot somewhat darker than surrounding normal leaf green. With age, the color deepens and becomes black. The spots remain on the leaf throughout the season and quite often kill

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the tissue. Spots also occur on the fruit. These look like scabs and is where the organism derives its name.

Frogeye: At first, tiny purple like specks appear; later they enlarge, leaving a brown or tan spot in the middle with a thin purple margin, giving somewhat the appearance of a frog eye.

Fire blight: Soon after bloom, whole terminals will droop and die. The leaves stay on these branches. The affected branches should be cut off at least 12 to 18 inches behind the affected area during the dormant season only, to aid in control. Shears or saw should be dipped in a 1 to 10 solution of sodium hypochlorite (a common household bleach such as Clorox) between cuts.

EARLY SUMMER AND SUMMER

Cedar apple rust: Small, pale yellow spots appear on the upper surface of the leaves in May. These gradually enlarge and turn orange in color. Later the center darkens and ruptures. Orange-brown spores are visible after it ruptures. This fungus survives the winter on cedar trees on which it causes galls. These galls produce bright orange or red gelatinous spore horns in the spring. The galls should be removed by hand where possible.

Powdery mildew: Both sides of the leaves turn powdery white in appearance. The whole young terminal turns white and twists and curls.

MIDSUMMER AND HARVEST

Sooty blotch and fly speck: This combination of diseases usually occurs together. Sooty blotch gives a sooty appearance to the apple. The sooty appearance can be wiped off with a damp rag. Fly speck appears as if a fly has been walking in circles on the apple leaving tracks; these cannot be wiped off.

Fruit rots: These are three-white rot, black rot, and bitter rot. With white rot the apple is gray-tan to almost white and is very watery when squeezed in the hand. With black rot the apple is dark brown with successive rings that have the same center. The apple is fairly firm and is not watery when squeezed. With bitter rot the rotted area is sunken or depressed. Bitter rot is “V” shaped when the apple is cut with masses of pink to cream white spores visible on the surface. Neither black rot nor white rot is depressed or sunken.

BRAMBLE INSECTS

Mites: See section under apples. Most serious on the variety Choctaw.

Sawflies: These are small green spiny caterpillar-like larvae that feed on the leaves. They usually eat the leaf surface, leaving only the large veins. The adults are stingless wasps and cause no damage.

Red-necked cane borer: This beetle larva causes a swelling or galling of the canes. It is most serious on raspberries. Infested raspberry canes usually die and break off. Blackberries canes will be less productive but do not break off. Pruning out infested canes is the best control.

Japanese beetles: These metallic copper (brown) and green beetles usually appear in large numbers and feed on the foliage (leaves) and fruit of many plants. They cause severe defoliation and can cause stunting, reduced production, and death of plants if defoliation is too severe.

Strawberry clipper: Predominantly a problem on blackberries. A small, 1/8th inch weevil that survives the winter in the duff under the plants and surrounding vegetation. Just prior to bloom the weevil lays eggs in the flower bud then girdles the flower bud, which is observed to flop over and sometimes drop from the flower truss. It is not clear if there is compensating increase in size of remaining berries. As much as 35% bud loss has been observed.

Raspberry crown borer: A small yellow jacket-like moth lays its eggs on the leaves in late August and September. A caterpillar migrates to the base of the cane where it creates a small cavity. In the spring, it resumes activity by boring into the cane frequently killing the fruiting cane just prior to harvest.

Blackberry/pine psyllid: A small 1/8 to 1/4 inch insect with tent-like wings that infests the shoots of primocanes (first year canes) causing puckered, twisted and curled terminals and leaves. The insect flies into the planting from nearby pine trees. Thorny varieties and Chester are susceptible.

BRAMBLE DISEASES

Anthracnose: This disease first appears in the spring on young shoots as small purplish, slightly raised spots. Later the spots enlarge and become oval with a slightly raised purple edge. The central portion gradually takes on a grayish color, becomes sunken and fissured. On the leaflets the spots appear as small indefinite purplish areas that later enlarge and turn brown. Most cultivars

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developed in the past 20 years have good tolerance with the need for spraying minimal.

Double blossoms (Rosette): This is a serious disease of erect blackberries. Short, broom-like clusters of growth arise from infected canes. Blossoms appear abnormal, redder and more wrinkled than normal. The flower parts are replaced with a mass of spores that drip down on emerging canes. Here infections are symptomless until the following year. Most thornless varieties are resistant. Shawnee is 100% susceptible.

Orange rust: Plantings should be inspected yearly when new shoots are 12 to 18 inches tall. Infected plants can be easily determined by their weak spindly growth and developing orange-colored pustules on the underside of the leaves. Infected plants should be removed immediately.

Spur blight: Spur blight occurs on fruiting canes and one-year (primocanes) canes. It is predominantly a raspberry problem with the variety Heritage very susceptible. A diseased plant will show weak growth so some or all of the laterals followed by wilting of the small leaves and fruit clusters if these have started to develop. The infected area, usually near a wound, leaf scar or pruning cut, turns dark purple, frequently along only one side of the terminal. The invaded bark tissue turns brown. Soon numerous black dots may be on older invaded tissue. With spur blight the new canes are also affected. Discolored brown or purplish areas appear below the leaf attachment. The leaflets will drop. Eventually the affected portions of the canes will turn gray and little black pustules will appear.

Cane blight: A fungus disease that invades cracked and fissured canes near the ground line eventually girdling the cane just prior to fruiting. A more serious problem on raspberries than other brambles.

Fruit rot: The ripe berries are susceptible to Botrytis and ripe rot that will turn them gray, brown or black. Maintaining a protective covering of fungicide on the blooms and as berries mature will help prevent these.

Viruses: Tomato ringspot, raspberry bushy dwarf and unknown viruses are a serious problem in brambles. The severity of reaction varies with variety. Symptoms include vein banding (lighter green areas along veins), chlorosis (yellowing), and a mottled appearance. Berry drupelets are incomplete making

berries off- shape and crumbly. Some of these viruses are vectored by dagger nematodes, therefore test the site for these nematodes prior to planting. Do not plant if present. Insist on virus free planting stock.

RASBERRY DISEASES

Raspberries are not generally recommended for home production due to their susceptibility to cane blight, Botrytis fruit rot and Phytophthora root rot. Low chilling requirements lead to resumed growth before the danger of freeze has passed and increased predisposition to cane blight. Limited success has been obtained growing fall-bearing types, like Heritage, for fall crops only. Spray programs used for blackberries may be used for raspberries. Select only well-drained sites or plant on a raised bed to prevent Phytophthora root rot and buy only disease-free plants. Do not plant within ¼ mile of blackberries because of the threat of viruses.

GRAPE INSECTS

Grape berry moth: Infestation is indicated by the webbing together of grape berries. They turn dark purple in color and drop off the stems when grapes are the size of garden peas. Small holes are eaten in the almost-ripened grapes. The infested clusters are webbed together and may include parts of leaves and frass. Small grayish-green caterpillars may be found inside damaged berries.

Grape root borer: This pest is a major problem on bunch grapes. Vines become weak and die for no apparent reason. Upon digging in the root system, various sized, round, white larvae may be found eating on the roots and trunk of the vine. These pests may be controlled by digging out the larvae or by covering the root area with 8 to 10 inches of soil around the vine in early August. The mound of soil should be removed from around the vines between November and February.

Rose chafer: This long-legged, fawn-colored beetle feeds on the leaves and blossoms of grapes. It is most numerous for the first 2 or 3 weeks after bloom.

Japanese Beetle: See section under Brambles.

Grape tomato gall fly: Large reddish-purple swellings occur on the leaves, flowers, and petioles. This is caused by a small fly; regular control measures will prevent its occurrence. The name comes from the tomato-like smell of the galls when they are crushed.

GRAPE DISEASES

Black rot: On the leaf, black rot appears in the late spring as a discolored dead spot, which at first is circular in outline and red in color. Later, when the spot attains a diameter of about $\frac{1}{16}$ inch, the margin appears as a black line, while the remainder of the spot is brown. On the upper surface of the spots, a few minute black dots appear, frequently arranged in a rather definite ring near the outer edge of the brown portion of the spot. On the berries, the first appearance of the spot is a whitish area about $\frac{1}{16}$ inch in diameter. This is soon surrounded by a ring of brown that widens rapidly. Once bunch grape berries reach 5% sugar they become resistant. In muscadine grapes, the sole visible berry injury is a small scab. Muscadine leaves will be as described above.

Downy mildew and powdery mildew: Although these diseases are both called mildew, they are distinctly different. In powdery mildew the actual fungus itself is found on both sides of the leaf as white patches that have a powdery appearance. But with downy mildew the fungus itself can only be seen on the bottom side of the leaf and is downy in appearance. On the upper surface, downy mildew appears as pale yellow, rather indefinite spots. Later the yellow spots may turn necrotic.

Anthracnose: This disease is often called “birds-eye-spot” because of the distinct spots it causes on the leaves, shoots, and berries. The spots are at first circular in outline but later conform to the tissue that is infected (on the leaves irregular, shoots oval, and berries round). The center of the spot is ash gray and is surrounded by a dark reddish-brown border. Only a problem on bunch type grapes.

Deadarm: As the name indicates, the most conspicuous symptom of this disease is the appearance in the spring of “arms” that fail to leaf out or produce dwarfed yellowish clusters of leaves. Close examination usually shows the presence of reddish-brown spots on green shoots, petioles and leaf veins. This disease invades wound from pruning cuts and other equipment. Cankered canes and arms should be removed.

Botrytis: A gray to tan powdery mold of the berries of bunch type grapes, especially wine type grapes. Protect flowers, immature and ripening fruit from infection with protective sprays of fungicides.

Ripe rot: Ripe rot affects both bunch and muscadine grapes. Symptom is a depressed lesion with creamy translucent to pinkish-white sporulation. Initiate sprays at cap fall.

Macrophoma rot: A soft watery circular rot of muscadine grapes, especially the Fry variety.

Bitter rot: The most serious problem of muscadine grapes. It causes tiny flecks on developing flowers and young berries that cause berry abortion, a necrotic scarring of berry surface, and a diffuse discoloration of maturing berries visible only on bronze and pink types but present on black/purple types, also. The disease shortens the post-harvest life of the berry significantly.

Phomopsis: Cool season early spring and late summer and fall disease of young succulent tissues of wine type grapes. Phomopsis causes small elliptical lesions on stems petioles and leaves.

Pierce’s Disease: this disease is caused by a systemic infection of a fastidious bacterial organism. It causes marginal necrosis, leaf drop and eventually death of the vine. It is not recommended to plant bunch and wine type grapes below 1300 ft elevation. Some cultivars have greater tolerance and can escape for several years. Muscadine varieties from North Carolina are more susceptible than those originating from Georgia and further south.

PEACH, NECTARINE, PLUM AND CHERRY INSECTS

Scales insects: Four different scales insects may be found on this fruit: White Peach scales, San Jose scale, Terrapin scale and European Fruit Lecanium. These are small insects that usually go unnoticed until populations begin to injure the tree. The Terrapin and European Fruit Lecanium are usually small and shiny brown in color, whereas the San Jose scale may be the same color as the tree bark and may give the tree a roughened appearance when the population is high.

The White Peach scale is easily recognized, as the males give the branch a whitewashed appearance. All these scales have more than one generation a year on peach, are very productive and can kill branches and even the trees if uncontrolled. These insects suck plant juices and gradually hinder tree development. The best time to control scales is in the crawler stages (just after

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hatching from the egg). Where populations are found, make checks and spray for live scales throughout the growing season.

Shothole borer: This small beetle is a serious pest of the young buds. They grow and reproduce in dead or dying wood in the tree or trees. They reproduce readily with overlapping generations. They feed on the buds as well as the trunks and branches. Their name comes from the numerous little holes that they make in the branches where they emerge resembling a branch shot by a shotgun. If the bark is removed, the wood beneath has numerous galleries and pockets with small white C-shaped larvae. Dead or dying branches or trees should be removed as soon as possible and destroyed. Sap oozing from numerous buds and small black beetles about $\frac{1}{16}$ inch long and round in shape.

Borers: Both the peach tree borer and the lesser peach borer are damaging to the trees. These larvae cause similar problems but attack the trees at different points. The lesser attacks the upper branches; the peach tree borers attack the roots. Both cause gummy flows of the sap that is visible on the outer surface of the tree. High infestations of the creamy white larvae can reduce production and kill the trees.

Oriental fruit moth: This small moth is highly damaging to the new growth and fruit. The larvae bore down the young shoots and into the fruit through the stems. The larvae eat out the seed and ruin the fruit. Fruit may show no signs of damage until after picking. Trees should be examined for new or young terminals that die suddenly. There are several generations a year, the later generation boring into the sides of the fruit much like the codling moths in apples.

Plum curcullo, catfacing insects and mites: See section under apples.

PEACH, NECTARINE, PLUM AND CHERRY DISEASES

Peach leaf curl: In the spring when the leaves first appear, they are much thicker, and, as they develop, the leaf blade becomes puffed and folded with the edge curling inward. These leaves at first appear bright red, pink, or purplish tints, which make them conspicuous. Later they turn reddish-yellow or yellowish-gray.

Scab: On the fruit during the early stages of development, the diseased areas are small, poorly defined, olive green spots. Later they enlarge to $\frac{1}{8}$ of an inch

or more and become dark olive brown. This disease is sometimes known by the name “freckles” because the spots look like freckles on the peach.

Brown Rot: The first evidence of the rot is a small circular brown spot frequently associated with a wound. The rot then develops very rapidly if the peach is mature or near maturity. The rotted area is smooth and not depressed. Sooner or later the rotted area becomes covered with ash-colored tufts, which give a brownish-gray appearance. Rotted fruits should be collected, removed from the orchard and buried. Also causes flower blight and girdling of shoots.

Botrytis flower blight: Predominantly a cherry and plum problem but occasionally noted on peach. It causes a blight of the flower that is difficult to distinguish from brown rot blossom blight.

Black knot (plum and cherry): Elongated swellings on smaller branches are indication of disease. The swellings are smooth at first, later swelling, enlarging, and becoming quite soft. They turn greenish in color at this point but later become coal black and hard.

Leaf spot (cherry): Spots can occur on leaves, petioles and fruit. Minute purple spots appear in the spring on the upper surface. Later these enlarge and become tan-brown in the middle. The size of the spots will vary with the variety and number of spots per leaf. In some varieties the center of the spot falls out. Generally leaves turn yellow and drop. Sometimes green islands form around the spots. Early and continuous defoliation can seriously affect tree vigor.

BLUEBERRY INSECTS

Blueberry maggot: Eggs are laid in ripe blueberries; the maggots eat the pulp of the fruit, causing fruit drop as well as difficulty in separating affected fruit from sound fruit.

Fruitworms: Cranberry and cherry fruit worms bore into the fruit causing deformation, discoloration and fruit drop. They may be noted by the silk webbing and frass they produce as they move from fruit to fruit.

Terminal borers: There are three of which only the *Oberea* is significant because of its interaction with the stem blight disease. Its characteristic double girdling injury distinguishes the *Oberea* from other borers.

BLUEBERRY DISEASES

Leaf spots: There are several foliar diseases of blueberries that defoliate the plants and decrease vigor and vitality. Varieties will differ in susceptibility; some are resistant.

Stem blight: Four diseases can cause stem blight. Botrytis stem blight is usually visible during the period just after bloom and is easily confused with Phomopsis stem blight. Phomopsis stem blight occurs just after bloom. With both of the above stem blights, the fungus invades the blossom or a mummy berry infected new shoot and from there progresses down the stem. Stem blight invades wounds, lenticels and shoots damaged by the *Oberea* stem borer. When the bush is under drought stress the disease becomes progressive and can move swiftly down the plant invading the crown. Once in the crown, it causes the eventual death of the bush. Cane canker, the fourth stem blight, involves the slow decline of individual canes and is predominantly a problem on northern high bush and its hybrids. New infections can be spotted in late summer and early fall as reddish conical swellings on growth of the current year. In the second year these swellings become enlarged, rough-fissured and sometimes turn gray. All diseased stems should be pruned and destroyed as soon as they are observed.

Mummy Berry: The fungus causing this disease infects emerging leaf shoots during March and April. Bees attracted to these shoots transfer spores to blooms. Infected bloom result in hard berries that resemble pumpkins in appearance. Early sprays of fungicide are important for controlling initial infections. Sanitation and mulching (bark only – no hard wood) over mummified berries can help.

Botrytis blight: During cool, wet weather, blooms can be blighted. The presence of the grey-tan mold on the dying bloom and shoot are diagnostic.

Fruit rots: The ripe berries are susceptible to several fruit-rotting diseases. Some turn then hard as with mummy berry above and others soft and mushy. *Alternaria* is recognized by gray, black to green sporulation and ripe rot as what looks like a dirty berry. Maintain healthy bushes to avoid these problems.

STRAWBERRY INSECTS

Mites: See section under apples.

Root Aphids: Infestation is noted by loss of vigor in plants, leaves becoming pale, fruit drying up and failing to mature properly. These pests are found on the roots of the plants. They are small and bluish green in color. Their presence may also be associated with a high ant population in the strawberry patch. Foliar aphids are seldom a problem in strawberries.

Strawberry Clipper: See brambles above. Compensation has been demonstrated in strawberries. Where fruit are clipped off the remaining fruit become larger.

Root feeding grubs: Several root feeding grubs infest strawberry fields. Generally these recognized as unthrifty and wilting plants during periods of stress. These are most likely to be a problem when fields are maintained in production for long periods of time. Rotate matted row systems to new areas when observed.

STRAWBERRY DISEASES

Foliar diseases: The leaf spot diseases may be seen first on the upper surfaces as small, deep purple, somewhat indefinite areas. As the spot enlarges, the central area becomes brown and then turns to definite white spot in older leaves and light brown in young, tender leaves. The leaf scorch disease is similar to leaf spot, except the center of the lesions never turns white and petioles and the fruiting stems are also attacked. The leaf blight disease is also similar except three zones of color are observed in the mature spots. From the outside in, they are purple, light brown, and then dark brown.

Fruit rots: There are three major fruit rots, anthracnose, gray mold and leak or Mr. Whiskers. In gray mold the berry turns light brown and is soft at first, but later becomes firm as the whole berry becomes involved. Mr. Whiskers is characterized by the soft watery tissue at the surface of the fruit and the ready leaking of this juice on slight pressure. Sunken lesions with creamy sporulation that can be popped out of the berry distinguish anthracnose. Mulching with fresh straw to prevent berries from touching ground and reducing rain splash will alleviate some of the disease.

PECAN INSECTS

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Pecan weevil: Adults are usually present from late July to late August. Each female lays eggs in the nuts, and the developing larvae feed in the nuts. At maturity the larvae fall to the ground to pupate. Most of the larvae will remain in the soil 2 years before emerging as adults. A heavy brood is produced every other year. Damage may be observed at harvest time by small holes in the shells and empty nut.

Shuckworm: These small larvae feed on the nuts as well as the outer husk. Early generations tunnel in the husk, preventing normal nut development and maturity. Heavy infestations early in the summer may cause heavy shedding of nuts.

Nut casebearer: Damage is easily recognized in June when infested nuts have been hollowed out at the base by a dark-colored caterpillar. Several nuts tied together by webbing is a good indication of infestation.

Spittlebug: These small insects produce a frothy, bubbly nest usually at the base of nut clusters, on the buds, and on tender shoots. Several immature spittlebugs may occupy a spittle mass. These insects suck the juice from the host, causing death to new shoots and buds, and result in smaller crops. The adults are pale brown with a reddish tinge. They are often called froghoppers.

Aphids: These are sucking insects that produce numerous generations a year if uncontrolled. There are two important aphids on pecans; (1) Black Pecan Aphid: Heavy infestations cause premature defoliation. Leaves develop yellow spots and gradually turn brown and die. (2) Yellow-Pecan Aphid

excretes large amounts of honeydew on the leaves, which supports sooty-mold development and causes trees to look unsightly and reduces nut quality.

PECAN DISEASES

Scab: Scab attacks leaves, petioles and nut shucks. The disease first appears as elongated olive-brown lesions, usually on veins of the undersides of leaves. On the nut shucks the spots at first are pinpoint size. Later they may enlarge and coalesce, and with further infestations, large areas of the shuck may become black.

Downy spot: In the late spring or summer, “downy” or “frosty” spots appear on the lower side of leaflets. Later greenish-yellow spots about $\frac{1}{8}$ inch in diameter remain on both sides of the leaves. Still later in the season these turn brown and can cause premature defoliation.

Brown leaf spot: Brown leaf spot first appears in June or July only on mature leaves. The spots are at first circular in outline and reddish-brown and then later develop grayish concentric zones. As the disease progresses, the spots become irregular in outline.

Powdery mildew: This disease is recognized by the white superficial growth, powdery in appearance, that covers the nuts and foliage. It is usually first observed in July.

Aflatoxins: They are toxic by products of certain fungi that grow on the meat of pecans left on the ground or stored improperly.

PESTICIDE SAFETY AND CONTAINER DISPOSAL

1. Use pesticides you have on hand for the purpose(s) indicated on the label and in accordance with the safety precautions and limitations specified thereon.
2. Purchase only as much pesticides as you have definite plans to use during one season.
3. Prepare only as much pesticide as needed at any one time to control a specific pest(s).
4. Use all spray that you prepare for any single application.
5. Use all pesticide that can be drained or removed from a container before disposing of it.
6. Rinse the container with several portions of the diluent being used (usually water) and add the rinsings to the spray.
7. Keep all container tops, lids, or bungs in place and all other containers securely closed when pesticides are not being used.

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8. Keep all containers, including empty ones, under secure storage until they can be properly disposed.
9. Wrap empty pesticide containers in several thick layers of newspaper, tie securely, crush, and/or break all empty containers, except the aerosol types (never puncture or burn aerosol-type container), and place in garbage cans.