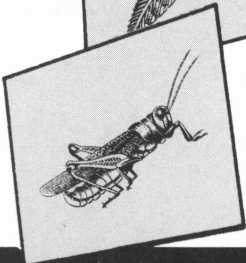
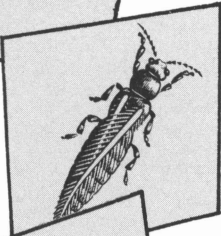
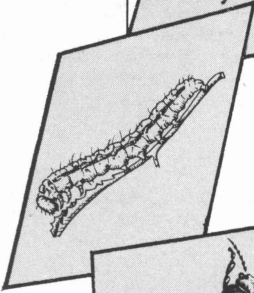
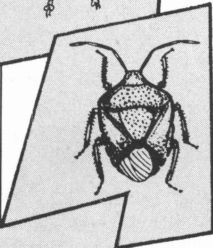
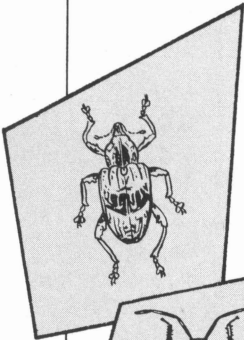


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Texas Guide for Controlling INSECTS and DISEASES

on
Fruits
and Nuts



THE AGRICULTURAL AND MECHANICAL
COLLEGE OF TEXAS
TEXAS AGRICULTURAL EXTENSION SERVICE
J. E. HUTCHISON, DIRECTOR, COLLEGE STATION, TEXAS

Texas Guide for Controlling Insects and Diseases on Fruits and Nuts

EXTENSION ENTOMOLOGISTS AND EXTENSION PLANT PATHOLOGIST
THE A&M COLLEGE OF TEXAS

INSECT AND DISEASE CONTROL is important in the production of fruit and nuts. Health and vigor of trees and quality of fruit depend on a well-planned and well-executed control program. Losses due to insects and diseases can be reduced by carrying through a spray program and diligently following good orchard sanitation practices.

When and How to Spray

Proper timing of spray applications is essential. The amount of spray required depends upon the size of the tree. Thorough coverage is necessary to obtain satisfactory control. Delays of longer duration than recommended permit insects and diseases to become established and cause extensive injury.

Spraying Equipment

Effective control of insects and diseases depends on good spraying equipment. Sprayers that will maintain a pressure of 300 to 400 pounds per square inch are recommended for peach trees and others of similar size. For pecans and other tall trees, 400 to 700 pounds pressure per square inch are needed.

When only a few trees are to be sprayed, smaller power or hand sprayers can be used.

Precautions on the Use of Insecticides and Fungicides

Correct materials must be selected for the most effective, safe and economical control. Observe manufacturers' directions for handling insecticides and fungicides. All materials recommended are safe, if handled in the prescribed manner.

Residues—Tolerances of insecticidal residues on fruit crops have been established by the Food and Drug Administration. Due to these regulations, certain insecticides should not be applied too near harvest. Refer to the spray schedule for information on the number of days that should elapse from last application to harvest.

Caution—Most insecticides and fungicides are poisonous. Use them with caution, and store them out of reach of children, irresponsible persons, livestock and household pets. Burn or bury empty containers. Dispose of left-over spray material properly. When handling parathion, avoid prolonged contact with the skin or breathing the vapors or drift from spray. Never handle parathion wettable powder or emulsion concentrate with bare hands. Persons handling parathion should wear natural rubber gloves—never synthetic rubber, leather or cloth gloves. Goggles and respirators should be worn.

Use the same precautions when working with dieldrin, except that usually you need not wear a respirator. Follow the safety rules on the container label. Confine chemicals to the property being treated. Avoid drift to adjoining forage crops or other produce ready for harvest.

Symptoms and Antidote—Some symptoms of parathion poisoning are: headache, nausea, cramps, blurred vision, weakness, muscular twitching and diarrhea. When symptoms of poisoning occur, consult a doctor immediately. Atropine is the recommended antidote. Persons affected with parathion poisoning should not handle the insecticide again without a doctor's advice.

DILUTION CHART FOR MIXING SMALL QUANTITIES OF SPRAYS

Fungicide or Insecticide	Amount per 3 gal. of water
BHC	1 tbsp.
Bordeaux mixture:	
Copper sulfate	4 tbsp.
Hydrated lime	6 tbsp.
Captan—50% W.P.	4½ tbsp.
DDT 50% W.P.	3 tbsp.
Dichlone 50% W.P.	¾ tbsp.
Dieldrin 50% W.P.	1 tbsp.
Dodine	1 tbsp.
Fixed copper 45% W.P.	3 tbsp.
Fixed zinc	6 tbsp.
Ferbam 76% W.P.	7½ tbsp.
Kelthane 18% W.P.	3 tbsp.
Malathion 25% W.P.	3 tbsp.
Maneb 75% W.P.	4 tbsp.
Methoxychlor 50% W.P.	3 tbsp.
Miscible oil 87%	¾ pt.
Sevin 50% W.P.	2 tbsp.
Toxaphene	5 tbsp.
Wettable sulfur	9 tbsp.
Zinc sulfate 36%	3 tbsp.
Zineb 75% W.P.	4 tbsp.

tbsp. = tablespoon, pt. = pint, W.P. = wettable powder

Spray Program for Small Peach and Plum Orchards

If a home owner has only a few peach or plum trees, a simplified spray schedule is suggested. Apply **methoxychlor** or **malathion** plus **wettable sulfur**; see the dilution chart for mixing small quantities of spray. The trees should be sprayed according to the following schedule:

1. Petal fall spray (when 75% have fallen)
2. Shuck split spray (10 days after petal fall)
3. First cover spray (10 to 14 days after shuck split)
4. Second cover spray (14 to 21 days after first cover)
 - A. Early varieties—Use only a fungicide (sulfur)
 - B. Mid-season and late varieties—Use insecticide and fungicide as in other spray schedules.

Listed below are the number of days that should elapse between last application and harvest:

Methoxychlor—	Peaches	21 days
	Plums	7 days
Malathion—	Peaches	7 days
	Plums	3 days

If bacterial spot is a problem, add fixed zinc, starting with the shuck split spray.

Formulations

Insecticides may be purchased as emulsifiable concentrates or wettable powders. Either may be used to spray fruit trees. However, in commercial orchards, wettable powders usually are preferred.

In many instances, it is necessary to mix insecticides and fungicides for insect and disease control. Fungicides usually are sold as wettable powders and should be mixed only with insecticides which are also in the wettable powder form.

PEACHES AND PLUMS

(For commercial orchards only)

TIME OF APPLICATION	INSECTS AND DISEASES	SPRAY MATERIAL AND AMOUNT PER 100 GAL. WATER UNLESS OTHERWISE STATED	NO. DAYS FROM LAST APPLICATION TO HARVEST	REMARKS
DORMANT	San Jose scale	4 gal. 97% miscible oil		Apply oil spray during dormant season in Dec. or Jan. If peach leaf curl has been a problem, apply this spray with a miscible oil.
	Peach leaf curl	4-6-100 Bordeaux mixture or 45% fixed copper plus adhesive—use as manufacturer directs.		
PINK BUD (optional)	Peach twig borer	3 lb. 50% wettable DDT	30	Apply pink bud spray to orchards in West Cross Timbers and Hill Country areas only. Peach twig borer is not a problem in East Texas. Apply in areas where brown rot has been serious the previous season.
	Brown rot	6 lb. microfine wettable sulfur or ¾ lb. 50% dichlone (Phygon XL)		
BLOOM (optional)	Brown rot	½ lb. 50% dichlone (Phygon XL) plus 3 lb. microfine wettable sulfur		Spray at 3 to 4-day intervals during bloom where brown rot has been extremely serious in previous season.
PETAL FALL (When 75% of the petals have fallen)	Catfacing insects (stink and lygus bugs)	½ lb. 50% wettable dieldrin plus 3 lb. 50% wettable DDT or 1¼ lb. 25% wettable parathion or 1 lb. 25% wettable Guthion	45 (Dieldrin) 14 (Parathion) 30 (DDT)	In orchards where scale and lesser peach tree borer are serious use parathion or Guthion in the regular spray program in addition to the oil spray applied in the dormant season for scale control. DDT is added to dieldrin to control peach twig borer. Do not apply dichlone later than petal fall.
	Peach twig borer		21 (Guthion) Peaches 15 (Guthion) Plums	
	Brown rot	6 lb. microfine wettable sulfur or ¾ lb. 50% dichlone (Phygon XL)		
SHUCK SPLIT (10 days after petal fall)	Catfacing insects, Peach twig borer, Plum curculio, Oriental fruit moth	Same insecticides as in PETAL FALL.	Same as in PETAL FALL	DDT is added to dieldrin to control the peach twig borer and oriental fruit moth. The oriental fruit moth is a pest in the East Texas area only.
	Scab	6 lb. microfine wettable sulfur		
	Bacterial spot (optional)	4 lb. fixed zinc (NuZ)		
FIRST COVER SPRAY (10 to 14 days following shuck split spray)	Same insects as SHUCK SPLIT	Same insecticides as in PETAL FALL	Same as in PETAL FALL.	If rainy weather persists, extra applications of fungicide must be made as often as necessary to maintain coverage of the fruit and dosage of sulfur should be increased from 6 to 8 lb. Protection from scab is important during the first 30 days following the shuck split spray.
	Scab	6-8 lb. microfine wettable sulfur	In no case should dieldrin be applied to plums after first cover spray (3 weeks after petal fall)	
SECOND COVER SPRAY (14 days after first cover spray)	Same insects as in SHUCK SPLIT	1¼ lb. 25% wettable parathion or 2½ lb. 50% wettable Sevin or 1 lb. 25% wettable Guthion	Parathion (14) Sevin (1) 21 (Guthion) Peaches 15 (Guthion) Plums	Dieldrin plus DDT may be used on late-maturing varieties of peaches. Do not apply dieldrin on peaches within 45 days of harvest or DDT within 30 days. Make at least two applications—one about 30 days, the other 14 days before harvest. It also may be necessary to apply before or during harvest.
	Brown rot and Scab	6 lb. microfine wettable sulfur		
THIRD COVER SPRAY (21 to 25 days after second cover or 30 days before harvest on late varieties)	Same insects as in SHUCK SPLIT and brown rot	Same as SECOND COVER	Same as SECOND COVER	Same as SECOND COVER. Do not use parathion within 14 days of harvest.
Preharvest	Miscellaneous insects	2½ lb. 50% wettable Sevin	Peaches and plums (1)	Will control a wide variety of insects and can be used very near harvest. Use if rain occurs during the last 2 weeks before harvest.
	Brown rot	5 lb. microfine wettable sulfur or 2 lb. 50% captan		
After harvest (plums only)	Rust and circular shot hole (Septoria)	2 lb. 75% zineb		Make 2 applications, one at 4 weeks after harvest and the other 8 weeks after harvest.
No more than 2 weeks after first killing frost (for susceptible varieties only)	Bacterial spot, leaf curl and Coryneum blight	4 lb. copper sulfate (bluestone) followed by 4 lb. hydrated lime		Apply separate applications of copper sulfate and hydrated lime the same day. Allow at least 1 hour interval between copper sulfate and lime sprays. Always apply the lime following the copper sulfate to avoid serious damage to trees.

PEACH TREE BORER: The peach tree borer is a pest only in East Texas. Adults lay eggs in the summer on the tree trunk. Eggs hatch in about 10 days. Borers enter the bark and feed on the cambium and inner bark at or below soil level. Any of the following treatments may be used:

1. Dieldrin Spray—Make two applications, one in early June and the second in mid-August. Use 3 pounds of 50 percent dieldrin wettable powder per 100 gallons of water. Apply material to runoff point on trunks of the trees. **TAKE EXTREME CARE TO PREVENT CONTAMINATION OF THE FRUIT.**
2. Thiodan Spray—Make two applications, one in early June and the second in mid-August. Use 1½ pounds of 50 percent Thiodan wettable powder per 100 gallons of water. Apply material to runoff point on trunk of tree. Do not apply Thiodan to the trunks of trees within 21 days of harvest.
3. Parathion Spray—Make two applications, one in early June and the second in mid-August. Use 1½ gallons of 25 percent parathion emulsifiable concentrate per 100 gallons of water. Apply 1 pint to 1 quart to the trunk of the tree. Use caution in mixing and handling parathion.
4. Paradichlorobenzene Crystals (PDB)—Treat between October 20 and November 15 when the soil is dry and soil temperature is 55 degrees F. or above. Remove weeds and loosen and level soil about 1 foot from the tree trunk. Place PDB crystals in a narrow circular band, preferably in a groove about 2 inches from the trunk. Place several shovels of clean soil over the crystals and mound the earth into a cone-shaped pile about 6 inches high around the base of the tree. In placing the first few shovels of soil, avoid pushing any of the material against the tree, since crystals in contact with the tree cause injury. Compact the soil with the back of the shovel. Remove earth mounds in early spring. For 2 and 3-year-old trees, use ½ ounce of crystals; 4 to 5-year-old trees, ¾ ounce; mature trees, 1 ounce.

LESSER PEACH TREE BORER: Damage occurs above ground in the trunk and limbs of the tree. The borers commonly occur where trees have been injured by implements, low temperature or other means.

Keep trees in a healthy-growing condition and as free as possible from wounds, cankers and winter injury. Borers can be controlled in the wounds by painting the affected areas with PDB in oil, prepared by dissolving 2 lb. of PDB in 1 gal. of a miscible dormant oil and diluting with 2 gal. of water. Treat only the affected areas and do not circle the entire trunk or limb. Apply during a warm, sunny day after the trees have shed all foliage.

For additional information on peach and plum diseases see MP-283, Peach and Plum Diseases.

APPLES AND PEARS

WHEN TO SPRAY	INSECTS AND DISEASES	INSECTICIDES AND FUNGICIDES Based on 100 Gal. of Spray	NO. DAYS FROM LAST APPLICATION TO HARVEST	REMARKS
WINTER	Scale	4 gal. of a 97% oil emulsion		Oil emulsion spray should be applied while trees are fully dormant.
Delayed dormant (after buds begin to break and show green)	Scab (When disease has been serious)	2 lb. 76% wettable ferbam 5 gal. liquid lime-sulfur	7	Scab causes small, olive-green, leaf spots that later turn black with an indefinite margin. Small, dark, scabby, spots occur on fruit. More apt to be a problem during years of above-average rainfall.
WHEN FIRST PINK SHOWS IN CENTER BUDS	Aphids	1-¾ lb. 25% wettable parathion or 2 lb. 25% wettable malathion for insect control plus	14 3 (apples) 1 (pears)	Aphids cause leaves on the terminal growth of the twigs to curl, become deformed and possibly die. Injury to the buds may develop also from heavy aphid infestation.
	Scab, leaf spots	½ lb. 65% wettable dodine (Cyprex) and 1 lb. 50% wettable Captan or 2 lb. 50% wettable Captan	7	See discussion below for cedar-apple rust control.
Bloom spray	Fire blight (on susceptible varieties)	1-3-100 Bordeaux mixture or Streptomycin (Agrimycin, Agri-Strep and Phytomycin)		2 sprays 4 days apart starting when 10% of blooms are open. Use at concentrations as manufacturer directs. Spray when 20-30% of bloom is open and every 3 to 4 days during blossom period. Do not apply after fruit is visible. See fire blight discussion below.
When 20-25% of the petals have fallen	Scab, leaf spots (when diseases have been serious)	½ lb. 65% wettable dodine (Cyprex) plus 1 lb. 50% wettable Captan or 2 lb. 50% wettable Captan	7	This is the period in which young plant parts are at their highest susceptibility to diseases.
WHEN 90% OF PETALS HAVE FALLEN	Codling moth, Curculio	1-¾ lb. 25% wettable parathion or 2 lb. 25% wettable malathion plus 2 lb. 50% wettable DDT	14 30	Proper timing of sprays is very important for control of codling moth and curculio. Codling moth worms do little feeding before entering the fruit.
	Scab, leaf spots	Same fungicides as when 20% to 25% of petals have fallen		
TWO WEEKS AFTER 90% OF THE PETALS HAVE FALLEN	Same as above plus fruit blotch	Same as above		If heavy infestation of leaf diseases and fruit blotch appear or if dropped fruits show codling moth infestations, apply two or more sprays at 2-week intervals.
When present	Mite	1-½ lb. 18-½% wettable Kelthane or 1 lb. 25% wettable parathion		

FIRE BLIGHT: Prune out twigs and limbs during winter. Make all cuts several inches below visible cankers. Sterilize cutting instruments after each cut by dipping in formaldehyde (1 part in 25 parts water). Coat pruning wounds with Bordeaux paint. Heavy pruning and over-fertilization of trees cause excessive growth which is susceptible to fire blight. See USDA Leaflet No. 187, Blight of Pears, Apples and Quinces.

MUSHROOM ROOT ROT: The roots of orchard trees, particularly apple and pear, commonly are attacked by the oak fungus CLITOCYBE sp. Diseased trees usually die soon after symptoms become visible in the above-ground parts of the trees. Careful separation of the bark from the wood in crown and large roots reveals fan-shaped growth of white strands—a distinctive characteristic of oak fungus. Control of the disease is difficult because the spores of the fungus which are produced in great numbers by the fruiting bodies (mushrooms), are spread long distances and over large areas by wind. Avoid planting new orchards in recently cleared land.

NEMATODES, CROWN GALL, HAIRY ROOT AND OTHER SOIL DISEASES: When replanting where old trees have been removed, fumigate an area 10' x 10' with 1 lb. of methyl bromide (Dowfume MC-2). Transplant disease-free trees.

CEDAR-APPLE RUST: Where cedar trees grow near apples or pears, rust may be a problem. Spray with 2 pounds of 76% wettable ferbam or 2 pounds 75% zincb in 100 gal. of water when first pink shows in center buds, when 20-25% of the petals have fallen and when 90% of the petals have fallen. To avoid undesirable residues do not use ferbam near harvest.

PECANS

TIME OF APPLICATION	INSECTS AND DISEASES	INSECTICIDES AND FUNGICIDES Per 100 Gal. of Spray	NO. DAYS FROM LAST APPLICATION TO HARVEST	REMARKS
Dormant (winter)	Scale and phylloxera	3½ gal. 97% oil emulsion		If dormant oil is not applied, use 2 pints of nicotine sulfate plus 6 pounds of soap; 3 pounds of 25 percent malathion wettable powder; or two and a half pounds of 10 percent gamma isomer BHC wettable powder per 100 gallons of water when the leaves are one-third grown.
Prepollination (when leaves are 1/3 grown and before pollen is shed)	Scab, downy spot and vein spot	2 lb. 75% wettable zineb or ½ to 1 lb. Dodine	45	Susceptible varieties should be sprayed thoroughly, using 1 gal. of spray for each foot in height of the tree. Do not graze meat or dairy animals in treated groves.
Soon after pollination or about the time the tips of tiny nuts turn brown. Eggs usually are deposited on tips of nuts. Examine tips of nuts for greenish-white eggs. Spray thoroughly when eggs are present.	Pecan nut casebearer	Thiodan—1 lb. 50% wettable powder DDT—3 lb. 50% wettable powder Parathion—2 lb. 15% wettable powder Malathion—3 lb. 25% wettable powder Toxaphene—5 lb. 40% wettable powder Nicotine sulfate—1 pt. 40% plus 2 qt. summer oil Sevin—2 lb. 80% wettable powder Guthion—1½ lb. 25% wettable powder		Do not graze livestock in treated groves. Do not apply after shuck split. Addition of 6 lb. wettable sulfur to DDT usually prevents mite infestation for remainder of season. Do not apply within 15 days of harvest or after shucks open. Do not allow animals to graze in treated groves until 15 days after application. Do not allow animals to graze in treated groves until 5 days after application. Do not allow dairy animals or animals being finished for slaughter to graze in treated groves. Remove all livestock for 3 days. Remove cattle from groves during spraying operations. No other limitations. No restrictions.
For control of rosette see MP-313	Scab, downy spot, vein spot, leaf blotch, brown leaf spot	Add 2 lb. 75% wettable zineb or ½ to 1 lb. Dodine for scab and other foliage diseases	45	Do not apply after husks split. Do not graze livestock in treated groves. During years of above-average rainfall 3 to 4 additional spray applications will be needed at 3 to 4 week intervals for scab control. Do not graze meat or dairy animals in groves treated with Dodine.
When present	Aphid	1 lb. 12% gamma BHC or its equivalent or 1 pt. 40% nicotine sulfate plus 3 lb. soap or 2 lb. 15% wettable parathion or 3 lb. 25% wettable malathion	Do not apply after shucks begin to open. 0 15 0	BLACK PECAN AND HONEYDEW—PRODUCING APHIDS suck juices from the leaves. Bright yellow spots appear around feeding punctures. These spots turn brown and cause leaves to drop prematurely. Black pecan aphid does not feed in crowded colonies. HONEYDEW—PRODUCING APHIDS usually feed in crowded colonies, causing leaves to curl and turn brown. In regard to grazing cattle in treated orchards, refer to "remarks" under casebearer.
When present	Mite	2 lb. wettable sulfur		Tiny pale green mites in webs may be found on the underside of the leaves. Heavy infestations produce a scorched appearance of the leaves and cause leaf shedding.
Late summer	Pecan weevil	6 lb. 50% wettable DDT	Do not apply after shucks begin to open.	Adults emerge in late summer, usually following rains. In areas where the weevil is a pest, begin checking for weevils during the first week in August by spreading a canvas underneath trees and jarring the lower branches. When three or more weevils are found per tree, apply spray. Refer to remarks listed under casebearer in regard to grazing cattle in treated orchards.

For additional information obtain a copy of MP-313, Pecan Diseases and Insects and Their Control.

GRAPES

WHEN TO SPRAY	INSECTS AND DISEASES	INSECTICIDES AND FUNGICIDES Based on 100 Gal. of Spray	NO. DAYS FROM LAST APPLICATION TO HARVEST	REMARKS
When new shoots are 1 to 2 inches long	Black rot and other diseases	8-8-100 Bordeaux mixture or 2 lb. 76% wettable ferbam or 2 lb. 75% wettable zineb or 2 lb. 50% wettable captan	7 7	Black rot disease, common in wet seasons, affects vines, leaves and fruit. The disease appears in the leaves as reddish-brown, dead spots, and in half-grown fruit as pale spots which turn brown, enlarge and soon involve the entire berry. Later, the infected berries may fall to the ground or remain in the cluster. All infected vines should be pruned, and the fallen mummified fruit and leaves, in which the fungus may overwinter, should be raked together and burned.
When shoots are 6 to 10 inches long	Black rot and other diseases	Same as above		If downy mildew is a problem use Bordeaux mixture or zineb.
Just before blooms open	Grape-berry moth, grape leafhopper, leaf-chewing insects Black rot and other diseases	2 lb. 50% wettable DDT for insect control plus same fungicides as above for disease control	40	GRAPE-BERRY MOTH larvae feed on pulp and seed of the fruit, passing from one grape to another and causing berries to become discolored with purplish spots and shrivel. GRAPE LEAFHOPPERS suck juices from the leaves. Foliage becomes yellow and brown-blotched. Insects usually feed on the underside of leaves. Plants attacked are greatly weakened and yields are reduced. Grape-berry moth and grape leafhoppers overwinter in rubbish or fallen leaves in the vineyard. Clean out and destroy these materials. LEAF-CHEWING INSECTS can be controlled with DDT as recommended for the grape-berry moth and leafhopper.
Just after berries set	Same as above	Same as above	Same as above	Same as above.
About 2 weeks after berries set	Black rot and other diseases	Use same fungicides as above.		During frequent rains repeat sprays at about 12-day intervals until 1 month before harvest.

COTTON ROOT ROT, CROWN GALL, PIERCE'S DISEASE, MUSHROOM ROOT ROT, NEMATODES AND CHLOROSIS: These diseases are apt to be problems in some areas. Contact your county agent for information.

If directions for use given on the manufacturers' label are carefully followed, your crop is reasonably safe from harmful residues.

The recommendations in this circular are based upon results of experiments conducted by the Texas Agricultural Experiment Station, of The A&M College of Texas and other research agencies.

For additional information, contact your county agent or write the extension entomologists, or plant pathologist, College Station, Texas.