

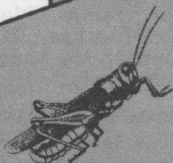
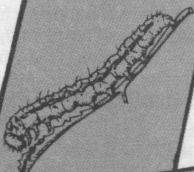
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Texas Guide for Controlling INSECTS and DISEASES

on
Fruits
and Nuts



TEXAS A&M UNIVERSITY

TEXAS AGRICULTURAL EXTENSION SERVICE

J. E. HUTCHISON, DIRECTOR, COLLEGE STATION, TEXAS

Texas Guide for Controlling Insects and Diseases on Fruits and Nuts

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HEALTH AND VIGOR of trees and quality of fruit depend on a well-planned, well-executed control program. Insect and disease losses can be reduced with a spray program and by diligently following orchard sanitation practices.

WHEN AND HOW TO SPRAY

Proper timing of spray applications is essential to prevent insects and diseases from becoming established and causing extensive injury. Amount of spray depends upon tree size. Thorough coverage is necessary for satisfactory control.

SPRAYING EQUIPMENT

Sprayers that 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 is needed.

When spraying only a few trees, use smaller power or hand sprayers. Close attention to thorough coverage is important.

PRECAUTIONS ON INSECTICIDE USE

Select recommended materials for most effective, safe, economical control. All materials recommended are poisonous, but they present little or no hazard when used properly. Comply with manufacturers' directions for handling insecticides or fungicides.

Residues—The Food and Drug Administration has established pesticidal residue tolerances on fruit crops. According to these regulations, certain chemicals should not be applied too near harvest. Refer to the spray schedule for 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. Properly dispose of left-over spray material. Observe explicitly all precautions on the pesticide label.

Pesticide drift—Avoid drift to adjoining forage crops or other produce ready for harvest. Take precautions against pond and stream contamination to prevent fish mortality.

Symptoms of poisoning—Some symptoms of insecticide poisoning are headache, nausea, cramps, blurred vision, weakness, muscular twitching and diarrhea. If any of these symptoms occur during or following the handling of any pesticide, consult a doctor immediately.

PREVENTIVE SPRAY PROGRAM FOR SMALL ORCHARDS

The simplified spray schedule below is for a homeowner with only a few peach trees. Apply methoxychlor or malathion and wettable sulfur. See the dilution chart for mixing small quantities of spray. Spray trees according to the following schedule:

1. Petal fall spray (when 75% of blossom petals have fallen)
2. Shuck split (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)

If infestations of fruit-damaging insects occur following the completion of the above schedule, use carbaryl (Sevin). Carbaryl can be used up to one day before harvest. Where plum curculio is a problem, use DDT or dieldrin with malathion and wettable sulfur.

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

	Peaches	Plums
DDT	30	30
Dieldrin	45	30
Methoxychlor	21	7
Malathion	7	3
Carbaryl	1	1
Sulfur	0	0

If bacterial spot is a problem, use two applications of fixed zinc, starting with the shuck split spray.

FORMULATIONS

Purchase insecticides as emulsifiable concentrates or wettable powders. Use either to spray fruit trees. However, in commercial orchards, wettable powders usually are preferred.

In most instances, insecticides and fungicides can be mixed for insect and disease control. Fungicides usually are sold as wettable powders. It is recommended that only wettable powder formulations be mixed.

DILUTION CHART FOR MIXING SMALL QUANTITIES OF SPRAYS

Fungicide or insecticide Amount per 3 gal. of water

Azinphosmethyl (Guthion) 25% W.P.	1½ tbsp.
BHC 12% gamma	1 tbsp.
Bordeaux mixture:	
copper sulfate	4 tbsp.
hydrated lime	6 tbsp.
Botran 75% W.P.	3 tbsp.
Captan 50% W.P.	4½ tbsp.
Carbaryl (Sevin) 50% W.P.	2 tbsp.
80% W.P.	1½ tbsp.
DDT 50% W.P.	3 tbsp.
Diclone 50% W.P.	¾ tbsp.
Dicofol (Kelthane) 18% W.P.	3 tbsp.
Dieldrin 50% W.P.	1 tbsp.
Dodine (Cyprex) 65% W.P.	1 tbsp.
Endosulfan (Thiodan) 50% W.P.	1 tbsp.
Fixed copper 45% W.P.	3 tbsp.
Fixed zinc (NuZ)	6 tbsp.
Ferbam 76% W.P.	7½ tbsp.
Malathion 25% W.P.	3 tbsp.
Maneb + zinc ion 80% W.P.	4 tbsp.
Methoxychlor 50% W.P.	3 tbsp.
Miscible oil 97%	¾ pt.
Toxaphene 40% W.P.	5 tbsp.
Wettable sulfur	9 tbsp.
Zinc sulfate 36% A.S.	3 tbsp.
Zineb 75% W.P.	4 tbsp.

tbsp. = tablespoon, pt. = pint, W.P. = wettable powder, A.S. = aqueous solution

PEACHES AND PLUMS

Commercial Orchard Recommendations

TIME OF APPLICATION	INSECTS AND DISEASES	SPRAY MATERIAL AND AMOUNT PER 100 GAL. WATER UNLESS OTHERWISE STATED ¹ (Where preferred, emulsifiable concentrate formulations can be used at the same rate of active ingredient)	NO. DAYS FROM LAST APPLICATION TO HARVEST		REMARKS
			Peaches	Plums	
Dormant	San Jose scale	Miscible oil — 4 gal. of a 97% oil emulsion	0	0	Apply oil spray during dormant season in December or January.
	Leaf curl	Bordeaux mixture — 4-6-100	0	0	If leaf curl has been a problem, apply a fungicide. All fungicides are compatible with miscible oil for scale control.
		Fixed copper and adhesive — 2 lb. 45% W.P.	0	0	
		Ferbam — 2 lb. 76% W.P.	21	7	
Pink bud (See remarks)	Peach twig borer	DDT — 3 lb. 50% W.P.	30	30	Apply pink bud spray to orchards in West Cross Timbers, Hill country and Seminole areas only. Peach twig borer is not a problem in East Texas. Captan does not irritate the eyes as sulfur does. COVERAGE SHOULD BE SUFFICIENT TO THOROUGHLY WET THE FOLIAGE AND FRUIT.
	Brown rot	Microfine wettable sulfur — 6 lb. or Captan — 2 lb. 50% W.P.	0 1	0 1	
Full bloom	Brown rot	Same as PINK BUD			Use if brown rot has been a problem.
Petal fall (When 75% of the petals have fallen)	Catfacing insects (stink and lygus bugs) Peach twig borer Plum curculio	Dieldrin — ½ lb. 50% W.P. plus DDT — 3 lb. 50% W.P.	45	30	In orchards where scale and lesser peach tree borer are serious, use parathion or azinphosmethyl in the regular spray program in addition to the oil spray applied in the dormant season. DDT is added to dieldrin to control peach twig borer.
		Parathion — 1¼ lb. 25% W.P.	14	14	
		Azinphosmethyl (Guthion) — 1 lb. 25% W.P. Same as PINK BUD.	21	15	
	Brown rot				
Shuck split (10 days after petal fall)	Catfacing insects Peach twig borer Plum curculio Oriental fruit moth Scab Bacterial spot	Same insecticides as in PETAL FALL. Same as in PETAL FALL. Fixed zinc (NuZ) — 4 lb. W.P.		PETAL FALL 0	Add DDT to dieldrin to control peach twig borer and oriental fruit moth. The oriental fruit moth is a major pest in the East Texas area only. Use ONLY on susceptible varieties of peaches. Do not use on plums.
			See remarks		
First cover spray (10 to 14 days following shuck split spray)	Same insects as SHUCK SPLIT Scab Bacterial spot	Same insecticides as in PETAL FALL. Same as PINK BUD. Same as SHUCK SPLIT.			Never apply dieldrin 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	Parathion — 1¼ lb. 25% W.P.	14	14	Dieldrin plus DDT may be used on late-maturing peach varieties. Do not apply dieldrin to peaches within 45 days of harvest or DDT within 30 days.
		Carbaryl (Sevin) — 2½ lb. 50% W.P.	1	1	
	Azinphosmethyl (Guthion) — 1 lb. 25% W.P. Scab and brown rot	Same as PINK BUD.	21	15	
Third cover spray (21 to 25 days after second cover or 30 days before harvest on late varieties)	Same insects as SHUCK SPLIT	Same as SECOND COVER.		Same as SECOND COVER.	Same as SECOND COVER.
	Brown rot	Same as PINK BUD.			
Preharvest	Miscellaneous insects Brown rot	Carbaryl (Sevin) — 2½ lb. 50% W.P.	1	1	Controls a variety of insects.
		Microfine sulfur — 6 lb.	0	0	Apply 1 to 2 days before harvest to reduce post-harvest rots.
		Captan — 2 lb. 50% W.P.	1	1	
		Botran — 1 lb. 75% W.P.	1	See remarks	Use only on peaches.

After harvest (PLUMS ONLY)	Rust and circular shot hole	Sulfur — 6 lb. W.P.	0	0
No more than 2 weeks AFTER first killing frost (for susceptible varieties only)	Bacterial spot Leaf curl Coryneum blight	Copper sulfate — 4 lb. followed the same day with 4 lb. hydrated lime.		This eradication procedure has been effective in several states. It has certain limitations includ- ing incompatibility between lime and other chemi- cals applied during early season. Damage can occur if lime does not follow the copper sulfate in the prescribed length of time. Apply separately copper sulfate and hydrated lime the same day. Allow at least 1 hour interval between applica- tions of copper sulfate and lime.

PEACH TREE BORER: Adults lay eggs in summer on the tree trunk. Eggs hatch in about 10 days. Borers enter and feed on the cambium and inner bark at or below soil level. Use any of the following treatments:

1. Dieldrin spray — Apply twice, once in early June and in mid-August. Use 3 lb. of 50% dieldrin wettable powder per 100 gallons water. Apply material to runoff point on tree trunks. **TAKE EXTREME CARE TO PREVENT CONTAMINATION OF FRUIT.**
2. Endosulfan (Thiodan) spray — Apply twice, once in early June and repeat in mid-August. Use 1½ lb. of 50% Thiodan wettable powder per 100 gallons water. Apply material to runoff point on tree trunk. Do not apply Thiodan to tree trunks within 21 days of harvest.
3. Parathion spray — Apply twice, once in early June and repeat in mid-August. Use 1½ gallons of 25% parathion emulsifiable concentrate per 100 gallons water. Apply 1 to 2 pints to the tree trunk. Use caution in mixing and handling parathion.
4. Paradichlorobenzene crystals (PDB) — Treat trees between October 20 and November 15 when the soil is dry and soil temperature is 55° F. or above. Remove weeds, 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. Avoid pushing any of the material against the tree, since crystals can 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 tree trunk and limbs. Borers commonly occur where trees are injured by implements, low temperatures or other means. Keep trees healthy and as free as possible from wounds, cankers and winter injury. Control borers in wounds by painting affected areas with PDB in oil, prepared by dissolving 2 lb. of PDB in 1 gallon of a miscible dormant oil and diluting with 2 gallons of water. Treat only affected areas and do not circle the entire trunk or limb. Apply on a warm, sunny day after trees have shed all foliage.

For additional information on peach and plum insects, see MP-785, Peach and Plum Insects.

GRAPES

TIME OF APPLICATION	INSECTS AND DISEASES	SPRAY MATERIAL AND AMOUNT PER 100 GAL. WATER UNLESS OTHERWISE STATED ¹ (Where preferred, emulsifiable concentrate formulations can be used at the same rate of active ingredient)	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	0	Black rot disease, common in wet seasons, affects vine, leaves and fruit. It 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 grape. Later, infected grapes may fall or remain in the cluster. Prune all infected vines. Rake together and burn fallen, mummied fruit and leaves in which the fungus may overwinter.
		or Ferbam — 1 lb. 76% W.P.	7	
		or Zineb — 2 lb. 75% W.P.	7	
		or Captan — 2 lb. 50% W.P.	0	
		or Folpet — 2 lb. 50% W.P.	0	
When shoots are 6 to 10 inches long	Black rot and other diseases	Same as above.		For downy mildew, use Bordeaux mixture or zineb.
Just before blooms open	Grape-berry moth Grape leafhopper Leaf-chewing insects	DDT — 2 lb. 50% W.P.	40	Grape-berry moth larvae feed on pulp and seed of fruit, passing from grape to grape and causing berries to discolor 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 are greatly weakened and yields reduced. Grape-berry moth and grape leafhoppers overwinter in rubbish or fallen leaves. Destroy these materials. Control leaf-chewing insects with DDT as recommended for the grape-berry moth and leafhopper.
	Black rot and other diseases	Same fungicides as above for disease control.		
Just after fruit set	Same as above.	Same as above.		Same as above.
About 2 weeks after fruit set	Black rot and other diseases	Same fungicides as above.		During frequent rains, repeat sprays at 12-day intervals until 1 month before harvest.

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

APPLES AND PEARS

TIME OF APPLICATION	INSECTS AND DISEASES	SPRAY MATERIAL AND AMOUNT PER 100 GAL. WATER UNLESS OTHERWISE STATED ¹ (Where preferred, emulsifiable concentrate formulations can be used at the same rate of active ingredient)	NO. DAYS FROM LAST APPLICATION TO HARVEST		REMARKS
			Apples	Pears	
Winter	Scale Blister mite Red mite	Miscible oil — 4 gal. of a 97% oil emulsion	0	0	Apply emulsion spray while trees are fully dormant.
Delayed dormant (after buds begin to break and show green)	Scab (When disease has been serious)	Ferbam — 2 lb. 76% W.P.	7	7	Scab causes small, olive-green leaf spots that later turn black with an indefinite margin. Small, dark, scabby spots occur on fruit. Apt to be a problem during years of above average rainfall. Use Ferbam ONLY during dormant season.
When first pink shows in center bud	Aphids	Parathion — 1¼ lb. 25% W.P. or Malathion — 2 lb. 25% W.P.	14 3	14 1	Aphids cause leaves on terminal growth of twigs to curl, become deformed and frequently die. Injury to buds may develop from heavy aphid infestation.
		Apple scab	Dodine (Cyprex) — ¾ lb. 65% W.P. or Captan — 2 lb. 50% W.P.	7 0	
	Cedar apple rust	Zineb — 2 lb. 75% W.P. or Ferbam — 2 lb. 76% W.P.	0 7	7 7	See discussion below on cedar apple rust control.
Bloom spray	Fire blight (On susceptible varieties)	Bordeaux mixture — 1-3-100 or Streptomycin (Agrimycin, Agri-Strep and Phytomycin)	0 50	0 90	Spray when 20 to 30% of blossoms are open and every 3 to 4 days during bloom period. Two sprays 4 days apart starting when 10% of blooms are open. Use at concentrations as manufacturer directs. Do not apply after fruit is visible. See fire blight discussion below.
When 20 to 25% of petals have fallen	Scab Leaf spots Cedar apple rust (When diseases have been serious)	Same as PINK BUD.			In this period young plant parts are at highest susceptibility to disease.
When 90% of petals have fallen	Codling moth Curculio Catfacing insects	Azinphosmethyl (Guthion) — 1¼ lb. 25% W.P.	15	15	Proper timing of sprays is important. Codling moth larvae do little feeding before entering fruit.
		Parathion — 1¼ lb. 25% W.P. or Malathion — 2 lb. 25% W.P. plus DDT — 2 lb. 50% W.P. Same as PINK BUD.	14 30	14 30	
		Scab Leaf spots Cedar apple rust			
Two weeks after 90% of the petals have fallen	Fruit blotch Powdery mildew	Same as PINK BUD. Wettable sulfur — 6 lb. or Dinocap (Karathane) — ¾ lb. 22.5% W.P.	0 21	0 21	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. Use only if powdery mildew is a problem.
When present	Mites	Dicofol (Kelthane) — 1½ lb. 18.5% W.P. or Parathion — 1 lb. 25% W.P.	7 14	7 14	

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 10% household bleach. Coat pruning wounds with Bordeaux paint. Heavy pruning and over-fertilization of trees causes excessive growth, which is susceptible to fire blight. See Fact Sheet L-726, "Fire Blight of Pear".

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 tree parts. Careful separation of bark from the wood in crown and large roots reveals fan-shaped growth of white strands — a distinctive characteristic of oak fungus. Control is difficult because wind spreads fungus spores which are produced in great numbers by fruiting bodies (mushrooms). Avoid planting new orchards in recently cleared land.

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

PECANS

TIME OF APPLICATION	INSECTS AND DISEASES	SPRAY MATERIAL AND AMOUNT PER 100 GAL. WATER UNLESS OTHERWISE STATED ¹ (Where preferred, emulsifiable concentrate formulations can be used at the same rate of active ingredient)	NO. DAYS FROM LAST APPLICATION TO HARVEST	REMARKS
Dormant (winter)	Scale and phylloxera (galls)	Miscible oil — 3½ gal. of a 97% oil emulsion	0	For phylloxera, spray tree trunks thoroughly with dormant oil emulsion. If dormant oil is not applied, use 1 quart of nicotine sulfate plus 6 lb. of soap; 3 lb. of malathion wettable powder; or 2½ lb. of 12% gamma isomer BHC wettable powder per 100 gallons water when leaves are one-third grown.
Prepollination (When leaves are ¼ grown and before pollen is shed)	Scab Rosette	Dodine — ½ to 1 lb. 65% W.P. or Maneb + Zinc ion coordinated fungicide 2 lb. 80% W.P. or Du-Ter — 0.3 to 0.6 lb. 50% W.P. or Polyram — 2 lb. 80% W.P. Zinc sulfate — 2 lb. 36% W.P.	See remarks	Spray susceptible varieties thoroughly, using 1 gallon of spray for each foot in height of tree. Do not graze meat or dairy animals in groves treated with Dodine, Maneb and zinc ion or Du-Ter. Dodine is phytotoxic to the Moore and Van Deman varieties and certain native trees. Do not apply after shucks split.
Soon after pollination as eggs appear on tips of nutlets	Pecan nut casebearer	Endosulfan (Thiodan) — 1 lb. 50% W.P. or DDT — 3 lb. 50% W.P. or Parathion — 2 lb. 15% W.P. or Malathion — 3 lb. 25% W.P. or Toxaphene — 5 lb. 40% W.P. or Nicotine sulfate — 1 pt. 40% A.S. plus 2 qt. summer oil or Carbaryl (Sevin) — 2 lb. 80% W.P. or Azinphosmethyl (Guthion) — 1½ lb. 25% W.P.	See remarks See remarks See remarks 0 See remarks 0 See remarks	Eggs usually are deposited on tips of nuts. Examine nutlet clusters for greenish white eggs. Spray thoroughly when eggs are present. Banding is of tremendous value in timing applications and in indicating need for second applications. Do not graze livestock in treated groves. Do not apply after shucks split. Addition of 6 lb. wettable sulfur usually prevents mite infestation for remainder of season. Do not apply after shuck split. Do not graze livestock in treated groves. Do not apply within 15 days of harvest or after shucks split. Do not allow animals to graze in treated groves for 15 days after application. No time or grazing restrictions. Do not allow dairy animals or animals within 6 weeks of slaughter to graze in treated groves. No time or grazing restrictions.
	Scab Downy spot Vein spot Leaf blotch Brown leaf spot Rosette	Same as PREPOLLINATION.	0 See remarks See remarks	Do not apply after shucks split. No other limitations. Do not apply after shucks split. Do not graze livestock in treated groves for 21 days after treatment. During years of above-average rainfall, 3 to 4 additional spray applications are needed at 3 to 4 week intervals for scab control. Do not apply fungicides after shuck split.
May or early June	Aphid	Disulfoton (Di-Syston) — 20 lb. 10% granules per acre or Disulfoton (Di-Syston) — 2¼ pt. 65.7% E.C. per acre	80 80	Season-long control where properly applied and where soil moisture is adequate for uptake. Irrigate immediately after application, where possible. Apply in 6 foot band on two or four sides of trees. Locate bands in tree's main "drip area". Work into upper 2 to 3 inches of soil in clean tilled groves and beneath grass roots (6-8 inches) in sodded groves. One application per season.
When present	Aphid	BHC — 1 lb. 12% gamma W.P. or its equivalent or Nicotine sulfate — 1 pt. 40% A.S. plus 3 lb. soap or Parathion — 2 lb. 15% W.P. or Malathion — 3 lb. 25% W.P.	See remarks 0 15 0	BHC — Do not apply after shucks split. Black pecan aphid sucks juices from leaves. Bright yellow spots appear around feeding punctures. Spots turn brown and cause leaves to drop prematurely. Black pecan aphids do not feed in crowded colonies. Honeydew-producing aphids cause leaves to curl and turn brown. Considerable honeydew and sooty mold growth will be observed where bright yellow aphids occur in numbers. In regard to grazing cattle in treated orchards, see "remarks" under casebearer.
When present	Mites	Sulfon... 8 lb. W.P.		

When present	Mites	Sulfur — 2 lb. W.P.	0	Tiny pale green mites in webs are on the underside of leaves. Heavy infestations make leaves look scorched and cause leaf shedding. If mite control with sulfur is difficult, use carbophenothion (Trithion), azinphosmethyl (Guthion), malathion, parathion or demeton (Systox). Repeated applications may be necessary for complete control.
Mid-August	Hickory shuckworm	Azinphosmethyl (Guthion) — 2 lb. 25% W.P. or EPN — 2 lb. 25% W.P.	21 See remarks 21 See remarks	Damaging populations are generally observed around mid-August. Begin application about August 15 or as soon as shucks harden. Apply 3 to 4 times at 10 to 14 day intervals. See remarks under casebearer above for grazing restrictions.
Late summer	Pecan weevil	DDT — 6 lb. 50% W.P. or Carbaryl (Sevin) — 2 to 3 lb. 80% W.P.	See remarks See remarks	Do not apply DDT or carbaryl after shucks split. Adults emerge in late summer usually after rains. Begin checking during the first week in August by spreading a canvas beneath trees and jarring lower branches. When three or more weevils are found per tree, apply spray. Refer to casebearer remarks regarding cattle grazing in treated orchards.

¹W.P. = wettable powder; A.S. = aqueous solution

For additional information see MP-313, Pecan Diseases and Insects.



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