PEST CONTROL

In Commercial Fruit Plantings

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University of Illinois · College of Agriculture
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CONTENTS

WHAT'S NEW in this circular . . .

For late apples in central and southern Illinois, the DDT schedule (page 12) replaces the lead arsenate-nicotine schedule. For peaches, the lead arsenate schedules have been replaced by the chlordane spray schedule and BHC dust schedule. A petal-fall spray is recommended for peaches for the first time. This is to control curculio, catfacing insects, and brown rot. Schedules using parathion have been devised for both apples and peaches.

On page 37 is a compatibility chart of orchard insecticides and fungicides. The efficiency of various mite sprays is given on page 14. Comments on new materials — including aldrin, dieldrin, "Aramite," "Dimite," etc. — are included in the notes on spray materials. Concentrate spraying is discussed on page 21. Brief directions for chemical fruit thinning sprays are also included (page 6).

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PEST CONTROL

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PART I

INSECT AND DISEASE CONTROL

EVERY ILLINOIS FRUIT GROWER who expects to make a success of his business must carry through a vigorous program of pest control every year. Each year the need for control measures becomes greater. In some kinds of orchards attention must be given this problem every season of the year.

Fortunately better methods of pest control are being constantly worked out by various experimental agencies. This circular brings together the latest recommendations from the Illinois, Kentucky, and Indiana Agricultural Experiment Stations, the Illinois Natural History Survey, and the U. S. Department of Agriculture. Some growers may need to adjust these recommendations to suit their own special conditions; but they are urged not to experiment with untested materials and methods. To do so is likely to lead to disaster.

CONTROL IN APPLE ORCHARDS

Sanitation Is Important

Sanitation has, in the past, aided greatly in reducing insects and diseases in Illinois apple orchards. With the general use of organic insecticides and fungicides and with the increased cost of hand labor, however, many growers are omitting such practices. Observations on codling-moth control have shown that there is less need for bark removal and banding when the spray schedule includes DDT. In orchards where DDT is not used codling moth still presents a problem and all of the following sanitation practices are recommended.

Remove all rough and loose bark from crotches, trunks, and branches. Do this "barking off" during the winter or by May 1.

Go high enough on the tree to get all bark that is so rough as to harbor codling moth larvae. Removing rough bark does two things: (1) destroys a large share of the overwintering larvae of the codling moth; and (2) prepares the trees for banding.

Directing a straight stream of water under high pressure against rough bark is an excellent way to remove it from apple trees. With power spray equipment, the rough bark can be taken from mature apple trees in 2 to 4 minutes in this way. Standard spray guns fitted with a disk that has an $\frac{8}{64}$-inch opening (No. 8 disk) should be operated at 500 to 600 pounds pressure at or near the full open position. Take care not to hold the gun in one position too long, as water at this pressure may tear through the solid bark. This method is excellent for removing punky wood and for cleaning out crotches and the area around the base of the tree near the ground line.

Scraping bark off by hand takes so much work and time that that method is being largely replaced by the water spray.

Fig. 1. — Chemically treated bands 2 to 4 inches wide are effective in killing codling moth larvae on trees that have had bark removed from trunks, crotches, and branches.

Band trees. Banding will reduce the summer broods of codling moth larvae 50 percent. Apply treated bands (Fig. 1) normally about June 10 to 30. The time for each section of the state will be announced by radio.

Thin out and destroy all damaged fruit as soon as discovered—fruit showing disease, insect injury, or rot. Break up fruit clusters.

Collect and remove all dropped fruit at frequent intervals. Do not let culls accumulate around packing shed.

Avoid coarse mulching materials. Clip sweet clover or other cover crops to prevent rank stem growth in which codling moth larvae might spin cocoons.

Store orchard crates and used baskets in a closed building. This will keep moths from escaping back to the orchard. Most of the moths can be collected and destroyed by darkening the building and hanging a light over a pan of kerosene. If crates are not stored in a closed building, dip the corners in fuel oil or kerosene. Stack props as far as possible from the orchard.

Screen the packing shed — if it is in the orchard and fruit was allowed to remain in the shed for any length of time during the harvest period.

Collect and burn all prunings and other debris. Destroy broken crates and baskets, discarded sacks, weed stems, cornstalks, cobs, etc.

Pruning Is Very Helpful

Good pruning is of utmost importance in good orcharding. For one thing, it acts as a sanitation measure to reduce certain diseases. Removal of twigs killed by blight or breakage will help to control frog-eye leaf spot and black rot infections. Pruning blighted twigs and cankers may reduce fire-blight infections.

Good pruning serves other important purposes. If branches are thinned out and the height of tall trees is reduced (Fig. 2) it is easier to get good coverage of the trees with spray material.

Fig. 2. — Tops of high trees should be lowered for convenience in spraying and harvesting. Fruit trees should not be allowed to grow more than about 20 feet high. If trees are already too tall, cut leaders back to horizontal lateral branches (*see arrows*). Too-heavy cutting, exposing too much of the top to the sun, may cause branches to sunscald. Light pruning, when the tree first begins to grow too high, is much better.

Such pruning is especially worth-while in orchards where spraying is done by the non-stop system. It also appears to be of utmost importance in securing maximum efficiency of concentrate sprays. Good pruning reduces the amount of spray required for thorough coverage of each tree; reduces fruit-thinning costs; and increases the quality of fruit.

Don't Neglect to Thin Your Fruit

Getting rid of surplus, defective, and low-quality fruit takes a big load off the tree. Limbs will rise, allowing better air circulation in tree. Sprays will dry faster, and spray injury will be reduced. Besides, fruit will be better color, size, and quality; picking costs will be lower; and there will be less low-quality fruit on the market.

A number of growers have become interested in chemical thinning. This method of thinning apples cannot be generally recommended. Results will vary with variety, tree vigor, concentration of material used, time of application, and weather conditions. For those who want to try thinning sprays, however, the following suggestions are made for guidance:

Hormones are more practical than dinitro materials because thinning may be done after bloom, when the set can be determined and there is little danger of further thinning by late frosts.

When heavy set is expected, use naphthaleneacetic acid hormones as follows:

1. Apply 1 or 2 weeks after bloom. Fruit cracking may result on Transparent and Duchess if sprays are made later than 2 weeks after bloom.
2. Use alone or in combination with the calyx or first cover spray.
3. Apply when weather conditions are favorable for drying.
4. For Golden Delicious, Transparent, Rome, and Wealthy use a concentration of 20 parts per million (double the strength recommended by the manufacturer for preharvest sprays).
5. For Grimes, Duchess, and York use 15 parts per million (1½ times the concentration for preharvest sprays).
6. For Jonathan, Delicious, and Winesap, use 10 parts per million (same concentration as for preharvest sprays).
7. Remember that it is very easy to over-thin trees low in vigor.
8. Spray thoroughly but do not over-spray, especially on the lower third of the tree, which is less vigorous than the upper part. A mist spray is better than a drenching spray.

Two Apple Borers Need Watching

There are two apple tree borers of importance in Illinois. Although neither is always present in apple orchards, both may cause very serious injury on trees up to about 12 years of age.

The roundheaded apple tree borer is prevalent mostly in the northern two-thirds of Illinois. The burrows of this insect are usually made in the base of the trunk. They extend from 1 to 2 inches below the ground level to a foot or more above ground.

Heavy DDT sprays with a suitable sticker are now being tested for the control of this borer. Sprays are applied by June, during the egg-laying period of the beetles. No recommendations can be made as yet, because effectiveness of the sprays has not been thoroughly determined. Anyone wanting to try this treatment on an experimental basis should write to the Illinois State Natural History Survey, Urbana.

The flatheaded apple tree borer works higher up the trunk than the roundheaded borer and sometimes infests the branches. This borer nearly always locates on the sunny side of a tree, though infestations may extend completely around a tree. Weakened trees are especially susceptible. Shading the trunk will give some control. Either wrap it, or put two boards, nailed together in the form of a trough, near the south and west sides. The best insurance against this insect is to keep trees in a good state of vigor.

Grasshopper Control

For several years grasshoppers have been troublesome in many orchards. Damage may occur on the foliage of young, nonbearing trees or on the fruit and foliage of bearing trees. To control this pest, use one of the following materials:

	Amount per acre for —		
	Young hoppers	*Adult hoppers*	*Residual toxicity*
Chlordane	½ lb. actual	1 lb. actual	Excellent
Toxaphene	1 ½ lb. actual	2 lb. actual	Excellent
Benzene hexachloride	0.3 lb. actual gamma	0.3 lb. actual gamma	Poor
Aldrin	2 oz. actual	2 oz. actual	Excellent

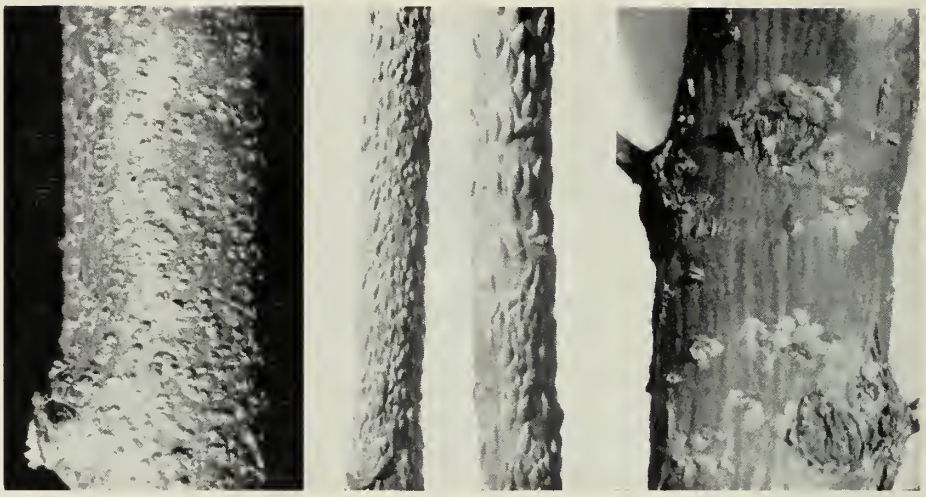


Fig. 3. — Some important scale insects in Illinois. San Jose scale is one of the most destructive pests in Illinois apple and peach orchards. Forbes scale, not shown here, has the same general appearance as San Jose scale and is also becoming a major pest on apples and peaches. Oystershell scale is of importance only in the northern half of the state. Scurfy scale causes little damage in well-sprayed orchards.

Fig. 4. — Three types of apple scab on leaves. (1) Diffused irregular spots. (2) Spots diffused but especially prominent along leaf veins. The most severe spray injury results when caustic sprays are applied to leaves showing this type of scab. (3) Well-defined spots; note also lesions on leaf stem.

Spray Schedules for Fall and Winter Apples

STANDARD SCHEDULE

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant — for scale insects, aphids, European red mite	Before the buds are open. Early spring is safest and most effective time	Dormant oil, 3 gal. actual; DNC, 1 lb. actual (*see page 33*) — or — "DN 289" or "Elgetol 318," 2 qt. (*see page 33*)
— for San Jose and Forbes scale, European red mite	.....	Dormant oil, 3 gal. actual
— for green and rosy aphid	.....	DNC, 1 lb. actual (*see page 33*) — or — "Standard Aphid oil," 4 gal.
— for apple scab (in problem orchards)	.....	"Elgetol" or "Krenite," ½ gal. (apply 500 gal. per acre to ground only)
Prepink, for apple scab	Before flower buds show pink (*Fig. 5, Stages 3 through 6*)	Liquid lime sulfur, 2 gal. — or — Dry lime sulfur, 8 lb. — or — "Puratized Agric. Spray," 1 pt. (*see page 34*)
Pink — for apple scab	When most of buds in cluster have separated (*Fig. 5, Stages 7 and 8*)	Same as prepink spray — or — Microfine sulfur, 8 lb.[a]
— If red-banded leaf roller is serious	.....	TDE, 1 lb. actual added to above spray
— If aphids are serious	.....	15% parathion, 1 lb. added to above spray (*see page 34 for precautions*)
(Do not use lead arsenate or other poisons in this spray)		
Bloom — for apple scab, cedar and quince rust	When 20% of the blossoms have opened	Microfine sulfur, 3 lb. 70% ferbam, ½ lb.
— for fire blight	.....	Copper sulfate, 2 lb. Hydrated lime, 4 lb.
Calyx — for codling moth, apple scab, curculio, red-banded leaf roller, rust	When ¾ of the petals have fallen (*see Figs. 6 and 7*)	Lead arsenate, 3 lb. 70% ferbam, ½ lb. Microfine sulfur, 3 lb.
— If red-banded leaf roller is serious	.....	TDE, 1 lb. actual added to above spray
— If curculio is serious	.....	Chlordane, 1 lb. actual
Calyx top-off, for same pests as calyx spray	Apply immediately after calyx spray to top ⅓ of tree	Same as for calyx spray

[a] Microfine sulfur refers to the many wettable sulfurs on the market, including 70-percent sulfur paste. A flotation sulfur paste, which contains only 40 percent sulfur, should be used at twice the recommended dosage.

(FOR REMAINING SPRAYS SEE PAGES 12-14)

Fig. 5. — Time apple sprays with development of fruit buds. Apply the **strictly dormant** sprays before Stage 1. Apply **delayed dormant** sprays during Stage 2. Apply **prepink** spray between Stages 3 and 6. Start the **pink** spray at Stage 7 (not later than 8), and complete by the time the first flowers open.

Fig. 6. (*above*). — Time to apply calyx spray for scab and codling moth. Petals have just fallen but calyx lobes are still open.

Fig. 7 (*right*). — Too late for calyx spray. Calyx lobes have closed.

HELPFUL HINTS

Sulfur dust applied between the prebloom sprays is an excellent supplementary control measure.

Lime-sulfur should not be applied to Jonathan, Ben Davis, and Golden Delicious varieties after the prepink spray.

Ferbam is a coined name for the fungicide chemical, ferric dimethyldithiocarbamate. This compound is sold under various trade names, as "Fermate," "Ferradow," "Niagara Carbamate," "Nuleaf," etc.

TDE is a coined name for the insecticide chemical, dichlorodiphenyl-dichloroethane. This compound is sold under various trade names, as "Diatox," "Rhothane," etc.

CENTRAL AND SOUTHERN ILLINOIS SPRAY SCHEDULE FOR FALL AND WINTER APPLES

Application and purpose	Time to apply	Materials in 100 gallons of water
1st cover, for curculio, codling moth, scab, blotch, rust, leaf roller	7 days after the calyx top-off spray	Lead arsenate, 3 lb. 70% ferbam, 1 lb.
— If curculio is serious	.....	Chlordane, 1 lb. actual added to above sprays
2d cover, for codling moth, red-banded leaf roller, leaf hopper, curculio, scab and blotch	Approximately 7 days after 1st cover spray. (*See spray service report*)	Lead arsenate, 2 lb. DDT, ½ lb. actual 70% ferbam, ½ lb.
3d cover, for codling moth, scale, bitter rot, black rot	10 days after 2d cover	Lead arsenate, 2 lb. DDT, ½ lb. actual Copper sulfate, ½ lb. Hydrated lime, 1 lb. Summer oil, 2 qt.
— If red-banded leaf roller is serious	.....	TDE, 1 lb. actual added to above materials
4th cover, for codling moth, scale, bitter rot, black rot	10 days after 3d cover	Same as for 3d cover
5th cover, for codling moth	14 days after 3d cover	Same as for 3d cover except omit oil (*For mite control see page 14*)
5th cover top-off, for codling moth	7 days after 5th cover	Same as for 5th cover
Special sprays, for bitter rot in problem blocks	7 days after 5th cover and repeat at intervals of 10 days for 4 applications	Copper sulfate, 4 lb. Hydrated lime, 6 lb.
2d- and 3d-brood codling moth sprays	Start 2 weeks after 5th cover top-off. Make 2 or 3 applications 10 to 12 days apart (*See spray service report*)	DDT, 1 lb. actual. If mites are present add mite spray as for 5th cover spray
Special spray, if red-banded leaf roller is present	When fruit injury appears	TDE, 1 lb. actual

NORTHERN ILLINOIS SPRAY SCHEDULE FOR FALL AND WINTER APPLES

(For dormant, prepink, pink, calyx, and calyx top-off sprays, use same materials as in standard schedule, page 9.)

Application and purpose	Time to apply	Materials in 100 gallons of water
1st cover, for curculio, apple scab, codling moth and leaf roller	7 days after the calyx top-off	Lead arsenate, 3 lb. Hydrated lime, 3 lb. Soybean flour, ¼ lb., Microfine sulfur, 6 lb.
2d cover, same as 1st cover	7 to 10 days after 1st cover	Same as for 1st cover. If leafhoppers are present, add DDT, ½ lb.
3d cover, for codling moth and apple scab	7 to 10 days after 2d cover	Lead arsenate, 3 lb.[a] Hydrated lime, 3 lb. Soybean flour, ¼ lb., Microfine sulfur, 2 lb.
4th cover, for codling moth and apple maggot	7 to 10 days after 3d cover	Same as for 3d cover
Special sprays for mites	When mites appear to be abundant	(*See page 14*)
2d-brood codling moth and apple maggot spray	(*Follow weekly spray service report*)	Lead arsenate, 3 lb.[a] Hydrated lime, 3 lb. Soybean flour, ¼ lb.

[a] If codling moth is severe, add DDT (½ pound actual) to 3d cover.

A simple way to figure amount of spray for apple trees: For *prepink* spray, divide age of tree by 4 to find gallons needed per tree. For *pink* spray, divide by 3; for *calyx*, divide by 2; for *succeeding* sprays, divide by 1.5. *Example:* a 10-year-old tree should be given the following amounts:

Dormant and prepink stages.....2.5 gallons
Pink stage.....3.3 gallons
Calyx stage.....5.0 gallons
Each succeeding spray.....6.7 gallons

SUGGESTED PARATHION SCHEDULE FOR FALL AND WINTER APPLES

Parathion is extremely dangerous to use and is not recommended. Some growers, however, may be willing to assume the hazards involved and use parathion in emergency sprays, **following the precautions on page 34.** Except for the pink spray (*see page 9*) the use of parathion is not suggested until the fourth cover spray. The standard schedule should be followed for all sprays up to the fourth cover.

Application and purpose	Time to apply	Materials in 100 gallons of water
4th cover, for all insects and mites	10 days after 3d cover	15% parathion, 2 lb.
5th cover, for all insects and mites	14 days after 4th cover	15% parathion, 2 lb.
5th cover top-off, for all insects and mites	7 days after 5th cover	15% parathion, 2 lb.
Special sprays	(*See standard schedule*)	(*See standard schedule*)
2d- and 3d-brood codling moth sprays	Start 2 weeks after 5th cover top-off. Make 2 or 3 applications if necessary, at 10-day intervals (*see spray service report*)	15% parathion, 2 lb.

SUGGESTED MITE SPRAYS

Material	Dosage to 100 gallons of water	Lasting effect	Toxicity to operator
"Aramite"	1½ to 2 lb.	3 to 4 weeks	None
"EPN 300"	¾ lb.	10 to 14 days	High
"Dimite"	1 pt.	3 to 4 weeks	None
"DN 111"	1¼ lb.	10 to 14 days	Low
40% TEPP[a]	¼ pt.	None	High

[a] This material is very poisonous. See page 35 for precautions.

Summer Apples

SPRAY SCHEDULE

(For dormant applications use those listed for fall and winter varieties.)

Application and purpose	Time to apply	Materials in 100 gallons of water
Delayed dormant, for blotch in heavily infected orchards	As late as possible, before too many leaves appear	Copper sulfate, 12 lb. Hydrated lime, 12 lb. "Dendrol" dormant oil, 2 gal.
Prebloom, for scab	When buds show the first pink	70% ferbam, 1½ lb.
Calyx, for scab, codling moth, and curculio	When ¾ of the petals have fallen	Lead arsenate, 3 lb. 70% ferbam, 1 lb. If curculio is likely to be serious add chlordane, 1 lb. actual
1st cover, for codling moth, curculio, scab, and blotch	7 days after calyx spray	Same as calyx spray
2d cover, for codling moth and blotch	10 days after 1st cover	Same as for 1st cover but omit chlordane
3d cover, for codling moth	7 to 10 days after 2d cover	"Black leaf 155," 3 lb. Summer oil, 2 qts. — or — Nicotine sulfate (40%), 1 pt. Summer oil, 3 qts.
4th cover, for early 2d-brood codling moth	(*See spray service report*)	Same as for 3d cover

Guard Against Spray Injury

1. Keep trees in **good vigor.**
2. Keep trees **well pruned** to get maximum air circulation for good drying.
3. Use **mist** sprays — do not apply sprays in a stream.
4. Do **not** apply lime sulfur when temperature **is 90° F. or above.**
5. Do **not** apply bordeaux mixture, lead arsenate, or lime sulfur during periods of **slow drying.**
6. When using ferbam or DDT with oil, **always add the oil last,** just before the tank is completely filled with water.
7. Do **not** let oil sprays with DDT or ferbam **stand in the tank** before using.
8. Always apply dormant oil sprays in **early spring,** never in the fall.
9. When using lead arsenate and lime sulfur in combination, **add hydrated lime.**
10. Never spray in the rain **except** with mild wettable sulfurs when they are necessary for apple scab control.
11. Do **not** use sulfur **with oil.** Never spray with oil within 10 days of the last sulfur spray.
12. Do **not** use DDT or ferbam **with miscible oil sprays.**
13. Do **not** use ferbam **in combination with** bordeaux mixture or within a week before or after bordeaux mixture.
14. **DO NOT EXPERIMENT** — use all spray materials according to directions.

SPRAY SCHEDULE FOR PEARS

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant, for pear psylla and scale	Before buds begin to open. Not needed every year	Dormant oil, 3 gals.
Calyx, for codling moth, curculio, leaf spot, and pear scab	As soon as petals have fallen	Lead arsenate, 3 lb. Hydrated lime, 3 lb. Microfine sulfur, 8 lb. — or — Lead arsenate, 3 lb. 70% ferbam, 1½ lb. (*see page 33*) Soybean flour, ¼ lb.
1st cover, for codling moth, curculio, leaf spot, and pear scab	10 to 12 days after calyx spray	Same as for calyx
2d cover, for codling moth, leaf spot, and scab	14 days after 1st cover	Lead arsenate, 3 lb. 70% ferbam, 1 lb. Soybean flour, ¼ lb.
3d cover, for codling moth, leaf spot, and scab	14 days after 2d cover	Lead arsenate, 3 lb. Copper sulfate, 1 lb. Hydrated lime, 2 lb. Summer oil, 2 qt.
Additional sprays		
— for codling moth and leaf spot.....	Same as for 2d-brood codling moth on apple, if necessary	Same as for 3d cover
— for psylla.....	When nymphs are visible on water sprouts	Copper sulfate, 2 lb. Hydrated lime, 4 lb. Summer oil, 6 qt. — or — 15% parathion, 2 lb. (*see page 34 for precautions*)

Fig. 8.—**PDB treatment for peach borers** consists of a "death ring" of paradichlorobenzene crystals (*left*) placed close to the trunk of the tree *but not touching the bark.* The ring of crystals is covered with a mound of earth (*right*) to confine the gas. (If you cannot obtain PDB, write to the Illinois Natural History Survey, Urbana, Illinois, for directions for using ethylene dichloride.)

PEACHES AND APRICOTS

Borer Control

The *peach tree borer* attacks plums, cherries, and nectarines, as well as peaches and apricots. It works at the base of the tree and if not controlled annually will kill the tree. Best control method is to apply 50-percent DDT (6 pounds to 100 gallons of water) from the crotch to the base of the trunk. Starting about July 8, apply three such sprays 3 weeks apart.

Reasonably good control may also be obtained by applying crystalline paradichlorobenzene (PDB) to the ground in a ring around the tree just far enough from the trunk so that it does not touch the bark, and then mounding with 3 to 5 spadefuls of earth (Fig. 8). Use the following amounts of PDB on:

Trees 1 year old, ¼ oz.
Trees 2 years old, ½ oz.
Trees 3 to 5 years old, ¾ oz.
Trees 6 to 10 years old, 1 oz.
Trees older than 10 years, 1 to 2 oz.

Fall treatments are more effective than spring treatments. Soil temperature should be 55° F. or over to volatilize the material. In general, the best dates for treatment are from September 25 to October 15, depending on latitude and soil temperatures.

The *lesser peach tree borer* works farther up on the trunk or in the crotches and injured places over the tree. It can be controlled by painting the affected areas with PDB in oil made up as follows: dissolve 2 pounds of PDB in 1 gallon of "Dendrol," or similar oil, and make up 2 gallons with water.

Bark beetles usually attack only weakened trees or branches, though occasionally they are found on healthy trees. Usually they can be controlled by increasing the vigor of the tree by means of fertilizers, proper drainage, or scale control. Frequently a heavy application of nitrogenous fertilizer corrects the trouble because the grubs generally do not thrive on fast-growing wood.

The PDB-oil treatment described for the lesser peach tree borer is also moderately effective in controlling bark beetles.

Virus Diseases of Peaches

Peach yellows, peach rosette, phony peach, and *yellow-red virosis* are virus diseases of peaches known to have been present in Illinois during the past ten years.

Peach yellows is often harbored in the plum, where the symptoms are inconspicuous. For this reason wild plums in the neighborhood of peach orchards should be eradicated. The yellow-red virosis is primarily a disease of chokecherry, but peach trees in the neighborhood of infected chokecherries may become infected. All chokecherries within half a mile of peach orchards should be destroyed. Common wild black cherry does not carry this virus.

If virus diseases are suspected, write the STATE NURSERY INSPECTION SERVICE, Glen Ellyn, Illinois, for an inspection.

Jarring peach and apricot trees is the only good way to get information on the abundance of the plum curculio, tarnished plant bug, and certain of the stink bugs (penatomids) in the orchard. (These insects are responsible for "catfacing" on the surface of peaches and apricots.)

A sudden jar of the main framework branches will make the insects fall to a sheet spread beneath the tree. They usually "play possum" long enough to be counted. Make a count on five trees, each in a different outside row (commonly the insects are most numerous near the edges of the orchard, especially if it borders a woods). The count indicates the general insect population of the orchard and aids in deciding when to spray and how much insecticide to use. Jar the same trees once a week, keeping a record of the number of curculio and other insects collected.

PEACHES AND APRICOTS: STANDARD SPRAY SCHEDULE

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant — for San Jose and Forbes scale, European red mite, leaf curl	In spring before the buds swell	Dormant oil, 3 gal. actual Copper sulfate, 4 lb. Hydrated lime, 3 lb.
— for scale and mites only	.....	Dormant oil, 3 gal. actual
— for leaf curl only	.....	Copper sulfate, 4 lb. Hydrated lime, 3 lb. — or — Liquid lime sulfur, 5 gal.
Bloom, for brown rot blossom blight and catfacing insects	Early to full bloom (*See footnote a*)	DDT, 1 lb. actual Microfine sulfur, 3 lb. "Phygon XL," ¼ lb.
Petal fall, for curculio, brown rot, catfacing insects	After petals are off [*See spray service report or jar for curculio (page 19)*]	Chlordane, 1 lb. actual (*see footnote b*) Microfine sulfur, 6 lb.
Shuck-split, for curculio, catfacing insects, brown rot	When ¼ of shucks are splitting	Same as petal fall spray
1st cover, for curculio scab	10 days after shuck-split	Same as petal fall spray
2d cover, for curculio, scab	10 days after 1st cover	Same as petal fall spray
3d cover, for curculio, oriental fruit moth, scab, brown rot	10 days after 2d cover	Chlordane, 1 lb. actual DDT, 1 lb. actual Microfine sulfur, 6 lb.
4th cover, for oriental fruit moth	7 days after 3d cover	DDT, 1 lb. actual. If mites are present see page 14 for mite sprays
5th cover — for curculio, oriental fruit moth, brown rot	1 month before harvest	Microfine sulfur, 8 lb. Chlordane, 1 lb. actual DDT, 1 lb. actual
— If leaf rollers are present	.....	TDE, 1 lb. actual, added to above materials
6th, 7th, and 8th covers, for brown rot	21, 14, and 7 days before harvest	Microfine sulfur, 8 lb.

[a] On varieties susceptible to blossom blight use additional sulfur-"phygon" sprays at 4-day intervals.

[b] Use 1 quart of 40-percent emulsion or 2 pounds of 50-percent wettable powder.

SUGGESTIONS FOR USING PARATHION IN THE PEACH AND APRICOT SPRAY SCHEDULE

Although parathion is a highly effective insecticide for many purposes, it is extremely dangerous to the operator. Therefore, it should not be used where a safer material will give reasonably satisfactory control. However, if the operator can enforce the proper precautions, its use may be justified in emergency situations.

For emergency purposes, substitute 15-percent parathion, 2 pounds, and microfine sulfur, 6 pounds, for the materials recommended in the third, fourth, and fifth cover sprays of the standard schedule. If leaf rollers appear to be developing to a serious extent, add TDE, 1 pound actual, in any one of the above covers.

Concentrate Spraying

Concentrate spraying is fast becoming an important saver of time and labor for a good many orchard men. The theory is to use the same amount of chemical per tree that is called for in the standard schedules, but to use less water. For example, a standard recommendation for DDT might be 1 pound actual to 100 gallons. With a conventional sprayer, about 600 gallons of this mixture would be needed to spray 1 acre of orchard 25 to 30 years old. If the spray were concentrated 3 times, then 3 pounds actual of DDT would be used to 100 gallons of water, and 200 gallons would be used on 1 acre of orchard. In each case, 6 pounds of DDT would be applied per acre.

Tests have been conducted with as high as 10 to 12 times the normal concentration. Thus far, however, it appears that 2 to 4 times is the most practical concentration for efficient control of orchard insects and diseases.

At present, specialized equipment such as the speed sprayer, mist blower, and liquid duster is used for concentrate applications. See your dealer for the types of nozzles to use.

DUST SCHEDULE FOR PEACHES AND APRICOTS USING BENZENE HEXACHLORIDE

(For dormant application see standard spray schedule, page 20.)

Application and purpose	Time to apply	Dust formulas
Bloom, for catfacing insects, blossom blight	Early to full bloom	Commercial DDT-sulfur dust (preferably containing "Phygon")
Petal fall, for curculio, catfacing insects, brown rot	When petals are off	Commercial benzene hexachloride dust (*see footnote a*)
Shuck-split, for curculio, catfacing insects, brown rot	When shucks begin to crack	Same as for petal fall
1st cover, for curculio and scab	When shucks are ⅔ off fruit	Same as for petal fall (*see footnote b*)
2d cover, for curculio and scab	7 days after 1st cover	Same as for petal fall
3d cover, for curculio and scab	7 days after 2d cover	Same as for petal fall
4th cover, for curculio	7 days after 3d cover	Same as for petal fall
5th, 6th, and 7th covers, for curculio and oriental fruit moth	At 7-day intervals after 4th cover. (*See spray service report for oriental fruit moth emergence*)	Same as for petal fall plus addition of 5% DDT
8th cover, for curculio, oriental fruit moth, and brown rot	One month before harvest	Same as for 5th, 6th, and 7th covers (*see footnote b*)
9th and 10th covers, for brown rot	At 15 and 7 days before harvest	Sulfur-oil dust (*see footnote c*)

[a] Commercial benzene hexachloride dust should contain approximately the following ingredients: benzene hexachloride, 1.0 percent gamma; sulfur, 50 percent; oil, 5 percent; inert ingredients, 44 percent.

[b] If red-banded leaf rollers appear spray with TDE, 1 lb. actual to 100 gallons of water.

[c] Sulfur-oil dust should contain approximately the following ingredients: sulfur, 65 percent; lime, 15 percent; talc, 15 percent; oil, 5 percent.

A 1-percent parathion dust with sulfur has been extremely promising in tests on peaches but is highly dangerous and should not be used unless all precautions are followed. An emergency schedule calls for applications at weekly intervals from petal fall until 3 or 4 weeks before harvest. Parathion is safest when applied with a liquid duster. Do not dust when the wind will carry the material into nearby residences. For other precautions, see page 34.

PLUMS

Plums are subject to only two virus diseases, *rosette* and *yellows*. The only way to control these diseases is to remove all infected trees promptly.

Black knot, a fungus disease, may be controlled by removing and burning, for two successive years, all twigs showing knots during the winter months. On large limbs the knots may be cut out, thus saving the limbs. Spraying is sometimes helpful. A delayed dormant spray made of copper sulfate, 12 pounds; hydrated lime, 12 pounds; and "Dendrol" dormant oil, 2 gallons, for each 100 gallons of water should be applied as buds begin to swell. On infected trees follow this delayed dormant spray with liquid lime sulfur, using 2 gallons in 100 gallons of water for the first and second cover sprays (this will take the place of the recommended copper sulfate - hydrated lime spray).

SPRAY SCHEDULE FOR PLUMS

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant, for scale insects	Before buds begin to open	Dormant oil, 3 gal.
1st cover, for curculio	Right after shucks have fallen	Lead arsenate, 3 lb. Copper sulfate, 1 lb. Hydrated lime, 2 lb. Summer oil, 1 qt.
2d cover, for curculio	10 days after 1st cover	Same as for 1st cover
Additional covers — for brown rot.....	At weekly intervals starting 3 weeks before harvest	Microfine wettable sulfur, 8 lb.
— for aphids.....	Apply when needed	Soap flakes, 4 lb. Nicotine sulfate (40%), 1 pt.

For borer control see page 18, peach tree borer.

SPRAY SCHEDULE FOR CHERRIES

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant, for Forbes scale	Before buds begin to open	Dormant oil, 3 gal.
Ground spray, for leaf spot	In early spring before buds begin to open. Apply to ground only. Use 500 gal. per acre	"Elgetol," ½ gal.
1st cover, for brown rot, leaf spot, curculio, and slug	Right after shucks have fallen	Lead arsenate, 3 lb. 70% ferbam, 1½ lb. Soybean flour, ¼ lb.
2d cover, for same pests as 1st cover	10 days after 1st cover	Same as for 1st cover
Additional sprays		
— for leaf spot.....	Right after harvest	70% ferbam, 1½ lb.
— for cherry slugs.....	In August.....	Lead arsenate, 2 lb. Hydrated lime, 6 lb.

Thorough Spraying Is Essential for All Fruits

Use adequate pressure. Do not rely on measurements of pressure gages after two or more seasons of service — have the gages checked.

Select disks with correct openings and replace worn disks. Be sure the disks will carry the maximum load. A 35-gallon pump should discharge at least 30 gallons a minute during full operation.

Spray tops of trees with special care. Equip the spray rig with a tower. Apply top-off sprays when recommended.

Examine fruit and leaves frequently. Look for evidence of disease and insect injury. See whether spray coverage is complete, especially in tops of trees.

Apply enough spray. And remember that one good spray is worth more than two poor ones.

BRAMBLES

Sanitation

Certain diseases of brambles such as *crown gall, orange rust, mosaic, leaf curl,* and *bramble streak* cannot be controlled by spraying. The following practices are recommended to aid in preventing these diseases:

(**1**) Do not replant on a site where diseased plants have been recently grown. (**2**) Select resistant varieties. (**3**) Order planting stock from a reliable nursery. (**4**) Have plantings of red and black raspberries as much as 300 feet apart. (**5**) As soon as diseased plants are detected, dig them up with as many of their roots as possible, and burn at once. (**6**) At planting time cut off old stubs of 2-year-old nursery stock and "handles" of young purple and black raspberries. (**7**) Remove and burn old fruiting canes immediately after harvest.

(For a full discussion of selection of varieties and cultural methods, see Illinois Circular 508, Bramble Fruits.)

SPRAY SCHEDULE FOR BRAMBLES

Application and purpose	Time to apply	Materials in 100 gallons of water
Delayed dormant, for anthracnose, spur blight, mites, and rose scale	In spring after growth has started but preferably before leaflets are ⅜ in. long	Liquid lime sulfur, 11 gal. — or — Dormant oil, 3 gal. Copper sulfate, 8 lb. Hydrated lime, 8 lb.
1st cover, for anthracnose, spur blight	7 to 10 days after delayed dormant	70% ferbam, 1½ lb. — or — Copper sulfate, 8 lb. Hydrated lime, 8 lb. Summer oil, 1 gal.
Prebloom, for anthracnose	7 days before bloom	Same as for 1st cover
— If fruit worms or sawfly larvae are present	.....	Lead arsenate, 2 lb., added to above spray
Special sprays, for mites	June and early July	*(See page 14)*
Post-harvest spray, for anthracnose and Septoria leaf spots and mites	Immediately after harvest	70% ferbam, 1½ lb. Summer oil, 1 gal. — or — Copper sulfate, 4 lb. Hydrated lime, 4 lb. Summer oil, 1 gal.

CURRANTS, GOOSEBERRIES, GRAPES

SPRAY SCHEDULE FOR CURRANTS AND GOOSEBERRIES

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant, for scale insects	Before growth starts	Dormant oil, 2 gal.
1st cover, for currant aphids and leaf spot	When leaves start to unfold	Copper sulfate, 4 lb. Hydrated lime, 6 lb. Nicotine sulfate (40%), 1 pt.
2d cover, for currant worm and leaf spot	When in full foliage; do not wait for worms to appear	Copper sulfate, 4 lb. Hydrated lime, 6 lb. Lead arsenate, 2 lb.
Additional covers		
— for leaf spot.....	2 sprays 2 weeks apart, following 2d cover	Same as for 2d cover except omit lead arsenate
— for worms feeding on plants in fruit.....	As needed	Rotenone garden dust or spray (*comparatively non-poisonous to man*)

SPRAY SCHEDULE FOR GRAPES[a]

Application and purpose	Time to apply	Materials in 100 gallons of water
Dormant, for scale and anthracnose	Before buds open (*seldom needed*)	Commercial liquid lime sulfur, 7 gal.
1st cover, for black rot and grape flea beetle	When new growth is 2 to 4 inches long	DDT, 1 lb. actual 70% ferbam, 1½ lb. Soybean flour, ¼ lb.
2d cover, for grape berry moth, rose chafer, black rot, and anthracnose	Just before the bloom	DDT, 1½ lb. actual 70% ferbam, 1½ lb. Soybean flour, ¼ lb.
3d cover, for grape leafhopper, grape leaf folder, grape root worm, rose chafer, black rot, anthracnose, and downy mildew	After bloom, when berries are set	Same as for 2d cover
4th cover,[b] for leafhopper, black rot, anthracnose, ripe rot, mildews	3 weeks after 3d cover	Same as for 2d cover

[a] This schedule is based on the supposition that each application will use approximately 250 gallons of spray per acre.

[b] Later applications of DDT and ferbam may be advisable, depending on the season. These sprays have not been recommended because of lack of knowledge concerning the residual problems which might arise.

STRAWBERRIES

Sanitation

Diseases and insects of strawberries can usually be controlled by cultural and sanitary methods. The following practices are recommended:

(**1**) To avoid white grubs, do not plant strawberries on sodland until it has been under cultivation for at least two years. (**2**) To reduce crown borer injury, separate new beds at least 350 yards from old beds and plow up the patch after two picking seasons. (**3**) Choose varieties resistant to disease in so far as possible. For example, in areas where red stele root rot is common, plant varieties resistant to this disease. (**4**) Renovate beds immediately after each harvest.

(For a full discussion of cultural and sanitation methods for strawberries, see Illinois Circular 453, Strawberry Culture in Illinois.)

SPRAY SCHEDULE FOR STRAWBERRIES

Application and purpose	Time to apply	Materials in 100 gallons of water
1st cover, for leaf spot and leaf roller	First appearance of blossoms	Copper sulfate, 4 lb. Hydrated lime, 6 lb. Lead arsenate, 3 lb.
2d cover, for leaf spot and leaf roller	Immediately after blossoming	Same as for 1st cover
Additional covers, for leaf roller on plants with fruit	As needed	Rotenone garden dust or spray (*comparatively non-poisonous to man*)

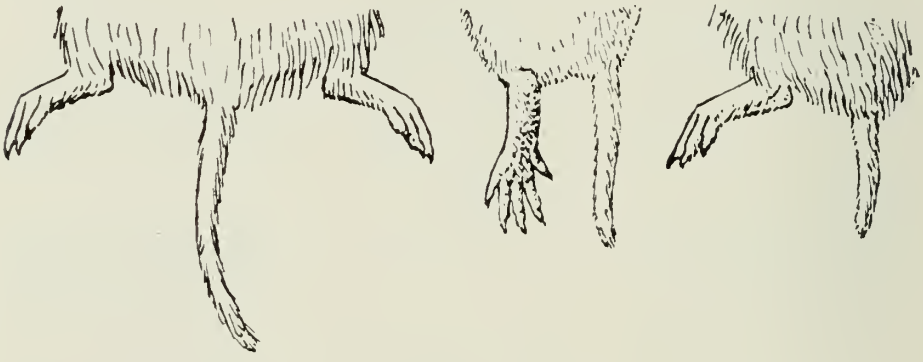
A dust containing 5 percent DDT and 5 percent chlordane is recommended for control of strawberry weevil and of insects causing buttoning of strawberries. Apply 30 pounds per acre when blooms first appear and again in one week. Tests in Kentucky indicate that if an additional application is made in the first part of March good control of the crown borer may be expected.

PART II: RODENT CONTROL[1]

Rodents take a heavy toll in killed and damaged trees each year. Definite programs should be adopted for control of these pests as for insects and diseases.

MICE

Mice do most of their damage to orchards in the dormant season. *Meadow mice, pine mice,* and *lemming mice* (Fig. 9) are found in Illinois. The *meadow mouse* is the most common. It has coarse, shaggy fur and can be distinguished by its tail, which is about twice as long as its hind foot measured from the hock to the tip of the toes. It feeds and lives largely above ground and has surface runways beneath the ground cover. In contrast, the *pine mouse* has compact, silky-fine, reddish-brown fur and lives and feeds largely below the surface of the ground. Its tail is barely longer than its hind foot. The *lemming mouse* looks somewhat like the meadow mouse but its tail is no longer than its hind foot. Its habits are practically the same as those of the meadow mouse.



Meadow mouse Pine mouse Lemming mouse

Fig. 9.—These are the mice that damage Illinois orchards. They are easy to distinguish by length of tail and other differences (*see text above*).

[1] These recommendations are adapted for the most part from material furnished by G. C. Oderkirk, Division of Predator and Rodent Control, U. S. Department of the Interior, West Lafayette, Indiana. For further information on controlling mice, write U. S. Fish and Wildlife Service, U. S. Department of Interior, Washington, D.C., for Conservation Bulletin 36, "Control of Destructive Mice."

A survey should be made each fall to determine whether mice are present. This can be done by walking up and down the tree rows, watching for mouse runways underneath the grass or mulch on top of the ground, and noting whether there are any small openings extending to runways underneath the soil surface. If there is evidence of mice, prepare for baiting.

Zinc phosphide is a very effective poison against all three mice just mentioned.

Preparation. Select small ripe apples about 1½ to 2 inches in diameter. Cut each apple in half and then slice each half into four equal pieces. If the pieces are cut smaller, mice may carry them away to store instead of eating them, thus making the bait ineffective. Do not peel or core. Place 3 to 5 quarts of the cut bait in a clean, dry metal pail or can. Measure *one level teaspoonful* of the zinc phosphide *for each quart of cut bait.* Dust this over the sliced apples and stir or shake until the bait is uniformly coated with the poison. It is then ready to use. One quart of bait will treat ⅓ to 1 acre of orchard, depending on the degree of infestation. Prepare fresh bait daily.

Application. Distribute bait systematically and thoroughly row by row. Use an ice pick or pointed stiff wire to place the bait. Mice require protective cover and seldom leave their trails under matted grass or other cover. For this reason bait containers of tile, glass, metal, or wood are no longer recommended.

Baits should be placed only in surface runways, mole burrows, and holes. Examine the cover crop for runways at about 12-foot intervals. Circle each tree and find the runways beneath the drip area. Where runways are found, 3 to 4 placements within the area should suffice. One apple slice at each baiting spot is enough. Place grass lightly over the bait. Mice commonly inhabit mole burrows. To avoid collapsing these burrows, put bait through a hole in the side rather than through the top.

If trees are mulched, raise the mulch, place the bait in the runways beneath, and let the mulch down again. Fencerows, low unplanted areas, spots where trees are missing, as well as adjoining fields of clover or alfalfa, should be baited.

Timing. The best time to bait an orchard is after harvest, when cool weather has caused mice to complete their migration.

This will vary from mid-October through mid-November. Mice are most active from the late forenoon until midafternoon; hence baiting is best done in the forenoon. Avoid very windy days, rainy days, or very cold days.

Precautions. Entrust preparation of bait only to reliable persons. Wash your hands and all utensils after mixing the bait, and at the end of the day wash all utensils in which bait was handled in the orchard. DO NOT HANDLE POISONED BAIT WITH BARE HANDS.

Use only zinc phosphide taken from airtight containers, as this material loses its potency when exposed to air. It is important to follow directions carefully.

Strychnine-treated grain bait is not so effective against the pine mouse (page 28) but will take care of the other two. It may be purchased already mixed from reliable dealers. Place a heaping teaspoonful of it at each bait location in surface runways, holes, or mole runways. It is worth the added trouble to put out both grain and apple bait so that the mice will have a choice.

RABBITS

During the winter, especially when snow is on the ground and food is scarce, rabbits feed on the tender bark of many kinds of young fruit trees. Protection may be secured by using a mechanical barrier or a chemical repellent.

Mechanical barriers. Mesh wire will keep rabbits from the trunks of young trees as long as necessary, or the trees may be wrapped each fall with paper of various kinds (Fig. 10). Veneer bands will also protect the trunks.

During deep snows the bases of the framework branches will need protection, since rabbits travel on top of the snow. Cottontail rabbits can reach about 2 feet.

Chemical repellent. The use of a chemical repellent is the least effective method for rabbit control. However, growers who wish to use a repellent can purchase one ready-mixed from the

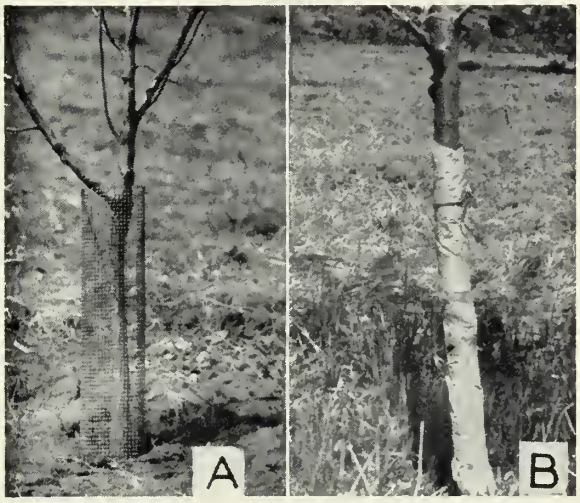


Fig. 10.—Protection of young trees against damage by rodents and insects is very important. Failure to do this, even for one season, may result in the complete loss of many trees. Galvanized gravel screen, 4 meshes per inch, placed around the trunk (**A**) gives protection against rodents. Wrapping paper tied around the trunk with twine (**B**) protects against both rodents and wood-boring insects.

District Agent, Division of Predator and Rodent Control, U. S. Department of Interior, *West Lafayette, Indiana.*

This material can be applied either as a paint or as a spray. When used as a paint it can be put on with a cheap paintbrush, without dilution but after it is thoroughly stirred. When using it as a spray, dilute each quart of the paint mixture with 2 quarts of ethylene dichloride.

Since cottontail rabbits can reach about 2 feet above the surface of the snow, the trunks and the scaffold branches of low-headed trees should be painted 2 feet higher than the snow is expected to drift. The amount of repellent required will, of course, depend upon the height of treatment and size of tree. One gallon will treat 150 to 200 two-year-old trees.

PART III
NOTES ON SPRAY MATERIALS

Aldrin. In two years' tests aldrin at the rate of ¼ to ½ pound to 100 gallons has given results equal to or better than chlordane at 1 pound. The cost is about the same. The use of aldrin has not yet been approved except for grasshoppers and certain cotton insects.

"Aramite." Sold most commonly as a 15-percent wettable powder, "Aramite" is compatible with most fungicides and insecticides except those of an alkaline nature. Two years' tests have shown this material to be very effective against mites. It has an excellent residual toxicity.

Benzene hexachloride. Mainly of interest for control of plum curculio and catfacing on peach. It is effective for only a short time, but has given good control when used as outlined in spray and dust schedules in this circular. When used as a spray it may give a musty flavor to fruit if too much is used or it is applied too late in season. Used as a dust, it has not tainted fruit. Will probably be used most commonly as a dust because frequent applications are needed and dust is cheaper. No injury to fruit or foliage from this chemical has been observed.

Bordeaux mixture. Made of copper sulfate (blue vitriol or bluestone), hydrated lime, and water. Copper sulfate can be bought as crystals, granules, or powder. All forms have same composition. *Indicate desired form when ordering.* Because of its convenience, growers like powder form. Crystals require several hours to dissolve. When possible, get hydrated lime from firms making a special spray lime. Do not keep lime from one season to another.

Formulas are indicated by numbers: ½-1-100 means mixture contains ½ pound copper sulfate, 1 pound hydrated lime, and 100 gallons water.

Most growers use instant method of mixing bordeaux, thus: Slowly sift copper sulfate into tank as it is being filled with water and the agitators are running. After adding 2/3 of water and *all the copper sulfate,* sift in lime while adding rest of water. *Always* add copper sulfate *before* lime.

If bordeaux mixture is to be used with oil, add the oil just before the tank is completely filled. Always add the oil *last.*

Chlordane. One of the most promising new insecticides. Marketed as an emulsifiable concentrate, a wettable powder, and a dust under various trade names. Has wide variety of uses but is of most interest to fruit growers for grasshoppers, plum curculio, and catfacing insects.

Four seasons' tests in Illinois and other states show that when chlordane is used as a spray it is much superior to lead arsenate for plum curculio on peaches. No objectionable features have yet been observed in chlordane.

"Crag 341." This material has proven very effective for apple-scab control and may have other places in the apple schedule. It has also shown promise for brown-rot control on peaches. Growers would be wise to use this material experimentally to become acquainted with it. Follow manufacturer's directions.

DDT. Now commonly included in spray schedules for *late apples* in *central* and *southern* Illinois. One of the most effective materials ever found

for codling moth and leafhoppers. Drawbacks are an increase in mites, red-banded leaf roller, and scale. Other hazards may develop.

Some growers feel they get better apples without DDT. General use is not recommended in *northern* Illinois, where codling moth is not usually a serious problem. For same reason it is not suggested for *summer apples.*

In spray schedule for *grapes* DDT has replaced lead arsenate and nicotine. Tests show it to be as good, frequently better, for control of berry moth. Excellent for leafhoppers. No drawback except a possible increase in mealy bug infestation.

Included in Illinois *peach* schedules, spray and dust. Apply *early in season* for catfacing insects and *later* (when twigs have hardened) for oriental fruit moth.

Dieldrin. In two years' tests ¼ pound to 100 gallons of water has given better control than any other material used on plum curculio. Because of its unusually long toxicity, dieldrin is especially good for use in the petal-fall stage. It will give protection if unfavorable weather should delay the regular sprays in the standard schedule. This material has not been released except for experimental purposes.

"Dimite." A water-miscible, amber-colored solution consisting of 25-percent active ingredient. It is compatible with most materials except those of an acid nature. Acts as a contact spray against mites and exhibits unusually long residual toxicity.

"DN 111." A wettable powder, very effective for mites on apples; somewhat more toxic to two-spotted mite than European red mite. In 100 gallons of water ¾ pound gives satisfactory control and is not so likely to injure fruit or foliage as 1¼ pounds recommended by manufacturer. If used when temperature is above 90° F. may injure fruit or foliage. Also causes injury when used with oil sprays. For control of mites spray inside of tree thoroughly.

"DN 289." A non-oil dormant liquid used at 2 quarts per 100 gallons of water in strictly dormant stage on apples. This material was very effective in 1949 tests. Do not use on peaches.

DNC (Dinitro-o-cresol). Marketed under many trade names as wettable powders and solutions. **"Elgetol"** and **"Krenite"** are 23-percent solutions of sodium dinitro-o-cresylate. **"DN Dry Mix"** is a wettable powder containing 50-percent dinitro-o-cresol. The solutions are used in dormant sprays on apples, as ground sprays for apple scab and cherry leaf spot, and also for blossom thinning. Do not use these compounds except in strictly dormant period, and **do not use on peaches at any time.**

"Elgetol 318." Another formulation of the same chemical used in "DN 289."

Ferbam. A common name for the fungicide chemical, ferric dimethyldithiocarbamate. Is marketed under several trade names such as **"Fermate," "Niagara Carbamate," "Ferradow,"** etc. May be used in apple schedule for scab, blotch, and cedar rust. May be substituted for or used with sulfur. May be substituted for bordeaux mixture or hydrated lime but must NOT be used in combination with either. Do not use before or after a bordeaux spray — may injure fruit and foliage.

Nicotine. Sold mostly as nicotine sulfate and "fixed" nicotine. *Nicotine sulfate* is primarily a contact insecticide. May be combined with many other sprays. *Fixed nicotines* are combinations of nicotine and other materials such as bentonite, oil, and DDT. Designed mostly for stomach poisons, as nicotine stays in spray residue for comparatively long time.

Oil sprays. *Summer oils* are made from highly refined white oils and an emulsifying agent. Mineral oils used on foliage should be paraffin type from a straight distillation run, not blended to meet sulfonation or viscosity specifications. Unsulfonated residue should be 85 percent or above, with a viscosity of 55 to 83 seconds, 100° F., Saybolt test. *Miscible oils* are concentrated emulsions, contain little or no water, and do not freeze.

Organic mercury. Formulations containing organic mercury include **"Puratized Agricultural Spray," "Tag 331,"** and **"Puratized Apple Spray."** These materials have given excellent apple-scab control in experiments over the past several years and are thus included in the Illinois recommendations. Since they contain mercury, these materials should be used *only* in the early sprays. Do not use with hydrated lime or oil sprays.

Organic mercury causes serious damage to fruit and foliage of peaches. Also, spray operators should avoid contact with the concentrated material.

Parathion. Parathion is a deadly poison and in view of the known hazards to those handling or applying it, its use is NOT RECOMMENDED. Although parathion is a highly effective insecticide for many purposes it should not be used where a safer material will give reasonably satisfactory control. Where situations demand it and operator is in a position to enforce proper precautions its use may be justified. Information on parathion is therefore given in this circular for guidance of those who will assume full responsibility for its hazards. For the use of parathion on apples, see page 14; for its use on peaches, see pages 21 and 22.

It is essential that these precautions be followed:

1. **Use only 15-percent wettable powder or 1-percent dust.**
2. **Do not use with oil.**
3. **Do not spray from the inside of the tree.**
4. **Use mask** to protect lips, nose, and mouth from accumulating residue, especially while emptying parathion sacks into the spray tanks.
5. **Stand out of the drift** when putting the powder into the tank or emptying the sacks of dust into the hopper for dusting.
6. **Do not wash the material through the screen** into the tank. Sift it in quickly with the screen removed.
7. **Do not breathe dust or powder.**
8. **Dust with the wind** and be careful of the turns at the ends of the rows. A duster or sprayer operated by one man with controls at the tractor is safer than the more common, manually operated, two-man outfit.
9. **Wash hands thoroughly** after each contact with the material and before touching the lips, eyes, etc., and before eating any food.
10. **Do not smoke** while spraying or dusting.
11. **Change clothes and bathe** at least daily. Accidentally soaked clothes should be replaced at once.

Atropine is the emergency antidote for parathion poisoning. Keep on hand a supply of atropine tablets (1/120 grain or 0.5 mg.). You will need a doctor's prescription to get them. Never take atropine or similar drugs until AFTER warning symptoms appear. Symptoms of parathion poisoning include headache, blurred vision, weakness, nausea, cramps, diarrhea, and discomfort in the chest. If you feel any symptoms while spraying with parathion, quit spraying, take two atropine tablets at once, and go to a doctor.

If you cannot rigidly follow ALL precautions, do not use parathion.

"Phygon XL." This material is very effective against peach brown rot blossom blight (page 20). It also has been used successfully for apple-scab control. Because of its toxicity to plants it should be used at the rate of ¼ pound plus sulfur, 3 or 4 pounds, to 100 gallons of water. "Phygon XL" has proved to be a skin irritant to some people. To avoid this difficulty, follow the precautions recommended by the manufacturer.

Sulfurs. Can be bought as liquid or dry lime sulfur, 70-percent sulfur pastes, microfine wettable sulfurs, ground wettable sulfurs, and fused and ground sulfur and bentonite.

Dry lime sulfur is more expensive than liquid but more convenient. Both forms are very efficient but more likely to cause injury than other sulfur fungicides. Next to lime sulfur, sulfur pastes are the most efficient sulfur fungicides. Have particle size of 1/25000 to 1/2500 inch. Not convenient to handle, but their mildness and efficiency offset their bulkiness.

Microfine wettable sulfurs are highly efficient. Have average particle size of 1/2500 inch. (*Microfine* commonly means dry sulfurs that have been especially treated to break them into small particles and make them wettable in water.) Select brands with care — fineness of particle is very important.

TDE. A common name of the insecticide chemical dichloro-diphenyl-dichloroethane. Has shown excellent results against the red-banded leaf roller. Will be marketed under various trade names such as **"Rhothane," "Diatox 25,"** etc. Recommended rate is 1 pound of actual TDE to 100 gallons of water.

Tetraethyl pyrophosphate (TEPP). Because of its extremely poisonous nature, THIS COMPOUND IS NOT RECOMMENDED. It is poisonous whether taken in through mouth or absorbed through skin. Very dangerous to eyes, causing contraction of the pupil and temporary blindness. *Following suggestions for mite control on apples are made only for those growers who want to risk the hazards involved:*

In 100 gallons of water use ½ pint of 20-percent concentrate (¼ pint of 40-percent) two or three times 7 to 10 days apart starting when mites first appear. May be added to regular codling moth sprays except when bordeaux or hydrated lime is used.

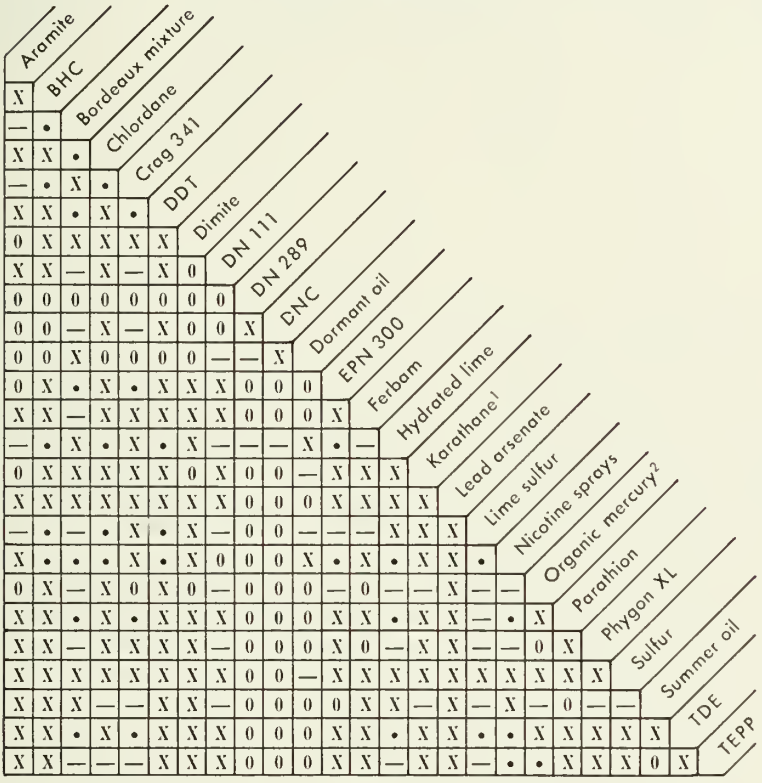
For protection of operator, *these precautions are imperative:* Do not use with oil. Use goggles to protect eyes. Do not spray from inside the tree. Do not expose hands, arms, or any other part of the body to either the concentrated or diluted mixture.

KEY FOR IDENTIFYING NEWER ORGANIC MATERIALS FOR CONTROL OF INSECTS, DISEASES, AND WEEDS

Common name, brand name or abbreviation[a]	Chemical	Use
Aldrin	Hexachloro-hexahydro-dimethanonaphthalene	Grasshoppers; curculio (experimental)
"Ammate"	Ammonium sulfamate	Weed killer
"Aramite"	Beta-chloroethyl-beta-(paratertiary butylphenoxy) -alpha-methylethylsulfite	Mites
BHC	Benzene hexachloride	Curculio, grasshoppers
Chlordane	Octachloro-methano-tetrahydroindane	Curculio, catfacing insects, grasshoppers
"Crag 341"	Heptadecyl glyoxalidine	Apple scab, cherry leaf spot, brown rot
2, 4-D	2, 4-dichlorophenoxyacetic acid	Weed killer
DD	1, 2-dichloropropane and 1, 3-dichloropropylene	Soil fumigant
DDT	Dichloro-diphenyl-trichloroethane	Codling moth, leafhoppers, oriental fruit moth, catfacing insects
Dieldrin	Hexachloro-epoxy-octahydro-dimethanonaphthalene	Curculio (experimental)
"Dimite"	Di(parachlorophenyl) methylcarbinol	Mites
"DN 111"	Dicyclohexylamine salt of 2, 4-dinitro-o-cyclohexyphenol	Mites; sooty blotch (experimental)
"DN 289"	Dinitro-o-sec-butylphenol	Dormant spray for mites, scale, and aphids
DNC	Dinitro-o-cresol	Scale, aphids on apple
"Elgetol"	Sodium dinitro-o-cresylate	Scale, aphids on apple Apple scab ground spray
"Elgetol 318" (See "DN 289")		
Ferbam	Ferric dimethyldithio-carbamate	Apple scab, blotch, cedar rust
"Krenite" (See "Elgetol")		
Lindane	Gamma isomer of benzene hexachloride	Curculio, grasshoppers
Parathion	o-diethyl-p-nitrophenyl thionophosphate	Mites, codling moth, scale curculio, etc.
PDB	Paradichlorobenzene	Peach tree borer
"Phygon XL"	2,3-dichloro-1,4-naphthoquinone	Peach blossom blight, apple scab
"Puratized Agricultural Spray"	Phenylmercuric triethanol ammonium lactate	Apple scab
"Puratized Apple Spray"	Phenylmercuric monoethanol ammonium acetate	Apple scab
"Tag 331"	Phenyl mercury acetate	Apple scab
TDE	Dichloro-diphenyl-dichloroethane	Red-banded leaf roller
TEPP	Tetraethyl pyrophosphate	Mites, cicadas
Toxaphene	Chlorinated camphene	Grasshoppers

[a] Brand names (in quotation marks) have been used only when necessary to clarify the existing confusion concerning the identity of these chemicals.

Compatibility Chart for Orchard Insecticides and Fungicides



[1] Karathane emulsifiable concentrates should not be used with sulfurs.
[2] Organic mercuries may be physically incompatible with some emulsifiable formulations.

Key to symbols

X Materials can be used together.

— Materials cannot be used together.

• Materials are physically compatible and their combination does not increase their damage to plant tissue. However, they are incompatible in that the residual effectiveness of either or both would be reduced.

0 There is no need to use materials together, or they should not be used together because of increased toxicity to the operator.

How to use this chart

This chart is made on the same principle as a mileage chart. For instance, if you want to know whether bordeaux mixture and DN 111 should be used together, you read down the column headed by "Bordeaux mixture" until you get to the row labeled "DN 111." The minus sign where the two meet indicates that the materials are not compatible and should not be used together.

(Orchardists will find this kind of spray record very useful.)

RECORD OF MY APPLE SPRAY SCHEDULE 195__

SPRAY	Started (date)	Finished (date)	Total gals. or tanks	Materials used or other remarks
Dormant				
Prepink				
Pink				
Bloom				
Calyx				
Calyx top-off				
COVER				
First				
Second				
Third				
Fourth				
Fifth				
Sixth				
Sixth top-off				
SECOND BROOD				
First				
Second				
Third				
Fourth				

RECORD OF MY PEACH SPRAY OR DUST SCHEDULE 195__

SPRAY or DUST	Started (date)	Finished (date)	Wind direc-tion	Amount of material used	Materials used or other remarks
Dormant					
Prebloom					
Bloom					
Shuck-split					
COVER First					
Second					
Third					
Fourth					
Fifth					
Sixth					
Seventh					
Eighth					
Ninth					
Tenth					
Eleventh					

Weekly Report on Orchard Insects and Diseases

Radio programs. Each Monday noon the ILLINOIS FARM HOUR gives latest information on controlling orchard pests. This program originates at W-I-L-L, the University of Illinois Radio Station, 580 on your dial.

Many other stations give similar service. Consult your local station, your farm adviser, or the Illinois Agricultural Experiment Station, Urbana, for details.

Reports by mail. Mimeographed copies of *The Spray Service Report*, carrying the same information as the radio programs, will be sent to Illinois orchardists under free mailing privilege at no cost to them. Anyone wishing to receive these weekly releases by faster mail may send 75 cents to pay for third-class mailing, or $1.00 for first-class mailing. (Either stamps or checks payable to the University of Illinois are acceptable.)

Out-of-state growers will be furnished this information under postage at the above rates if the total number of requests is not too large.

These weekly reports are prepared by the agricultural experiment stations of Indiana, Kentucky, and Illinois, the Kentucky State Horticultural Society, the Federal Deciduous Fruit Insect Laboratory at Vincennes, Indiana, and the Illinois State Natural History Survey.

It is probable that the federal government will establish spray-residue tolerances for DDT, TDE, parathion, and chlordane, as well as all other poisonous agricultural chemicals, by harvest-time, 1951. If these materials are used in the concentrations and at the times suggested in this circular, there should not be excessive spray-residue on the fruit at harvest. Do not use such materials at greater rates than recommended, for there is no evidence as yet that heavy residues can be removed by washing.

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