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EC1231 Managing the Home Orchard

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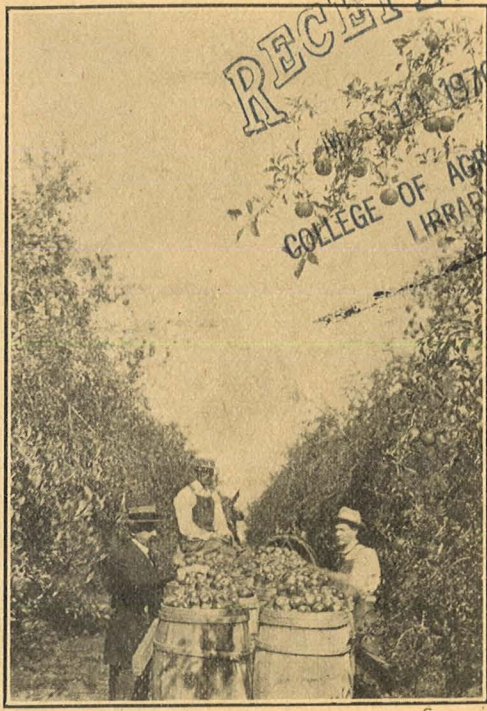
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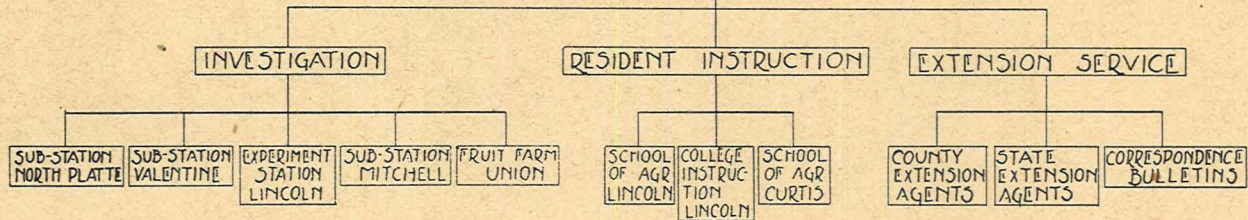
Managing the Home Orchard



THE UNIVERSITY OF NEBRASKA
AGRICULTURAL COLLEGE
EXTENSION SERVICE

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COLLEGE OF AGRICULTURE



MANAGING THE HOME ORCHARD

BY R. F. HOWARD AND E. H. HOPPERT

There is an increasing demand for information on home fruit production. Extension Circular No. 1230 "Establishing the Home Orchard"* discusses plans for arranging the different fruits, varieties suitable for different parts of the state, planting, etc. The object of this bulletin is to offer definite suggestions which will enable the small orchard owner to give his fruit plants the attention they need with regard to culture, pruning and spraying.

It is probably no exaggeration to state that fully one-half of the fruit trees and plants sold to inexperienced growers die before they reach fruiting age. A very high per cent of the ones that do live bear only a few crops of inferior fruit until they too die on account of disease, insect pests or general neglect. Practically all of this loss may be prevented by giving the plants a little seasonable care. The amount of time and expense necessary for caring for a home orchard is not great. Certain practices like the spraying of apples to control scab and codling moth, or the pruning of grapes, may be carried out each year without much alteration. On the other hand a severe drought or the sudden appearance of some insect or disease may require special action. The most successful fruit grower is the one who knows how and when to do the regular operations and who gives his plants enough attention to know when they need additional care.

CULTIVATION

EARLY CULTURE

Garden vegetables or any crop requiring clean culture may be grown between the fruit trees while they are young. As the orchard becomes older this practice should be discontinued. The intensive culture for a young orchard is primarily for the purpose of stimulating good vigorous growth. The conditions which favor maximum growth, however, are often unfavorable for fruit production. It is considered good practice to not force the tree to make excessive growth about the time it reaches an age when it should begin to bear. Different methods may be used to check the growth sufficient to induce fruit bud formation. Apple trees that have made rather rapid growth should be induced to begin bearing when they are six or seven years old. Pruning at this time should be reduced to a minimum and culti-

*This circular will be sent to anyone upon application to any county extension agent or the Agricultural College, Lincoln, Nebraska.

vation should be discontinued in midseason or the land should be put to crop such as red clover for the purpose of checking the growth of the tree. It is doubtful whether such deep rooted moisture-consuming crops as alfalfa and sweet clover should ever be used unless the orchard is located where there is an abundance of moisture or under irrigation. Blue grass sod should never be allowed in the orchard. In a few years it checks the vegetative growth of the tree to an extent that strong fruit bud formation is inhibited.

CULTURE FOR BEARING TREES

After the apple, plum and cherry trees have begun to bear, cultural methods should be used that will keep them growing moderately. A moderate rate of growth would be an annual increase in length of the outside twigs of 10 to 12 inches for trees under 15 years of age or one-half this amount for old trees. Pear trees should not be cultivated because of their greater susceptibility to twig blight when growing rapidly. Their growth should be checked by means of blue grass.

One of the best means of inducing tree growth under Nebraska conditions is the conservation of moisture by cultivation. Clean cultivation may be used to advantage every season in the central and western parts of the state except where the orchard is so situated that satisfactory growth is made without annual culture. In the eastern third of the state where the rainfall is greater it is not necessary to cultivate every year. Clean culture one season in three or four years is sufficient where red clover is used occasionally or where general applications of barnyard manure are made.

Red clover is probably the best crop for bearing orchards in those sections of the state where it can be grown successfully. It is a legume which adds fertility to the soil in the form of nitrogen and it increases the water holding power of the soil by the addition of humus. When it is grown in the orchard, the first crop should be cut while in bloom and spread under the trees. This acts as a mulch, keeps down weed growth and adds humus. The mulch should be kept a foot or more away from the tree trunks to avoid damage by mice. The second crop should be cut when the seed is ripe and left on the ground. It is usually possible to reseed the land in this way and retain the clover for more than two years. It is well to turn it under at the end of two to four years and stimulate growth by cultivating the orchard for one or two seasons.

Where red clover does not do well the fertility and humus supply of the orchard may be maintained by the use of manure. From five to ten tons of well rotted barnyard manure added to an acre of orchard every year or two will keep the trees in a good state of vigor. This practice should be supplemented with some culture to incorporate the manure with the soil, to conserve moisture, and to keep down weed growth. It is most convenient and probably best to apply the manure early in the spring before growth begins. Where manure is not available in sufficient quantity, rotted straw may be used to advantage.

Orchards under irrigated conditions may be easily kept in the proper state of vigor. Two or three applications of water are sufficient for one season. For mature trees, where there is no crop in the orchard the water should be applied by means of small ditches four to five feet apart between the rows. The water should be allowed to stay on long enough to wet the soil to a depth of two feet. Clean culture should then be practiced to keep a surface mulch. Late irrigation in August should be avoided on account of the danger of forcing second growth and thus inducing winter injury. Alfalfa may be grown occasionally in a bearing orchard if there is sufficient water to maintain both crops.

If it is necessary to use a stirring plough in the orchard to subdue blue grass sod or to turn under a green crop, it should be set so as not to go over four or five inches deep. Many of the trees' feeding roots are near the surface of the ground and deep ploughing would check growth. A disc that can be adjusted to extend under the branches is an excellent tool for cultivating the orchard.

The dead and dying apple trees in most old home orchards are the direct or indirect result of neglect with regard to cultivation. Where an orchard is allowed to shift for itself it may make a reasonably satisfactory growth until it is about fifteen years of age. After this time it is apt to decline rapidly, especially if blue grass sod has become established. Apple trees of standard varieties should be thrifty and productive at fifty years of age under Nebraska conditions if given proper attention.

GRAPES AND SMALL FRUITS

Clean cultivation for grapes and all of the small fruits is to be generally recommended. On account of the tendency of grapes to continue growing until the approach of fall, it is well

to discontinue cultivation in early August. This will check length growth and cause the wood to become more mature, thus aiding it to better withstand the severe conditions of winter. Crab grass, foxtail and other annual weeds may make a considerable growth after August, but it will not be difficult to subdue them in the spring. They aid in checking late summer growth and also act as a mulch to protect the grape roots from winter injury. An effort should be made in cultivating to avoid throwing the dirt away from the row to an extent that would eventually leave the plants on a sharp ridge. The yield and quality of the fruit will be improved by the addition of manure. Currants and gooseberries are gross feeders and respond especially well to fertilization.

Blackberries and raspberries should be given clean culture to conserve moisture and to prevent young from becoming established between the rows.

PRUNING*

Pruning a plant disturbs the natural balance between the root system and the top and one of the direct results of it is to stimulate vegetative growth. Excessive growth often opposes fruitfulness. The amount of pruning a plant needs depends upon the kind of fruit, age, fertility of soil, etc. Grapes require severe pruning for best results. Tree fruits that have just reached bearing age should be pruned lightly while old trees require more pruning. Under fertile soil conditions the plant or tree may grow so rapidly as to be unfruitful unless the pruning and other operations are carried on with a view of checking growth. Under such conditions most of the pruning should be done in early June instead of the dormant season.

APPLES

Trees that have been properly pruned and trained the first five or six years need but little pruning. The water sprouts should be kept off, pronounced leaders shortened and ingrowing branches removed. The fruit spurs developing along the main branches should not be mistaken for water sprouts or ingrowing branches. Trees that have been allowed to reach five or six years of age without sufficient pruning will have too many large branches arising from the trunk. This condition should

*See Extension Circular No. 1230 "Establishing the Home Orchard" for a discussion on pruning while the plants are young.

be corrected in order to give the tree a proper form and to avoid crotches. Six or eight branches should be left at different heights and on different sides of the trunk to serve the needs of the tree. This severe pruning will stimulate growth. It may check fruitfulness for a year or two, but it is necessary in order to get the tree to the proper form. In the case of neglected trees ten to twelve years old, the branches from one quarter of an inch to one inch in diameter should be removed from the outer portion of the trees to relieve the dense growth, to let in light and air and to make it possible to do a thorough job of spraying.

Old apple trees that have been neglected all their lives usually need a general renovating treatment consisting of a severe pruning accompanied by cultivation and thorough spraying. This pruning should involve the removing of all dead and dying branches and a general thinning out of the dense growth. It is not uncommon in old orchards to find the trees approximately one rod apart in the row with the branches interlocking in such a manner as to shut out the air and sunlight. This is not only conducive to the development of fungous disease but it is practically impossible for the tree to form and develop fruit under such close competition. It is advisable in extreme cases of this kind to remove alternate trees.

The following precautions in pruning may be applied to apples as well as other trees: Paint all wounds over an inch in diameter as soon as they are dry with white lead thinned with linseed oil. Use a sharp saw or pruning tool that will leave a smooth surface without ragged edges. The branches should be removed close up so as to avoid leaving a stub even tho the wound is somewhat larger. Where it is necessary to shorten a branch over one year old, cut back to a lateral. Disinfect the pruning tool frequently with corrosive sublimate, 1 part to 1000 parts water or carbolic acid 1 part to 500 parts water, if diseases such as blight and canker are present. Diseased branches that are pruned off should be taken from the orchard and burned since they may continue to serve as a source of infection.

PEARS

Most pear trees are very susceptible to a bacterial disease known as "fire blight." It does not attack the trees as readily if they are kept in a slow growing condition. For this reason the trees should be kept in sod and no more pruning done than

is necessary to keep off the water sprouts and to correct the growth slightly. While the tree is fairly young its upright habit of growth can be somewhat overcome by pruning the main branches to an outside lateral.

CHERRIES

After cherry trees have begun to bear the pruning may be restricted to the removal of a few small branches near the outside to relieve the dense growth and weak shaded branches in the center of the tree. Spraying to keep the foliage in a healthy condition is more important than pruning where cherry leaf spot is present. (See Fig. 1).

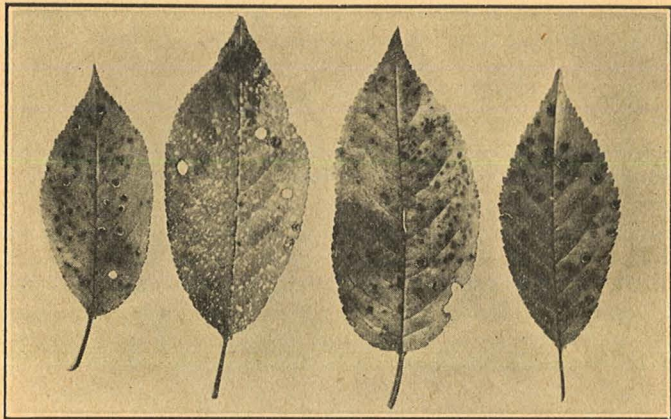


Fig. 1—Cherry leaf spot.

PLUMS

Some varieties of plums tend to produce long branches which if left unpruned may later break or split off under a heavy load. The long terminal branches should either be shortened annually in one-year-old wood or cut back occasionally to a lateral in older wood. This will make a more compact head. The removal of water sprouts and slight thinning of the outside branches as in case of the cherries, is advisable.

GRAPES

Pruning is the most important operation in the growing of grapes. When left unpruned old vines will soon become a tangled mass of wood most of which is unproductive. To prevent this it is necessary to prune severely every year. Each season's pruning should be done with a view of leaving the proper amount of fruiting wood and maintaining the desired shape of the vine. The fruiting wood consists of the light colored canes with smooth bark which grew the previous season. From four to six of these should be left for each vine and cut to a length of three or four feet. (See Fig. 2). The mature canes with short joints are better than the long jointed, more immature ones.

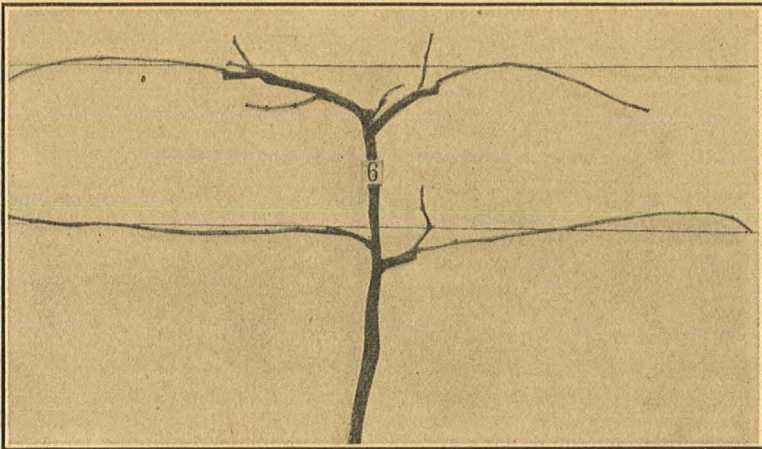


Fig. 2—Old grape vine, properly pruned. The short spurs are for the purpose of producing fruiting canes for the following year. The long canes on the wire will produce shoots on which the fruit is borne.

The vine should not be allowed to accumulate an excessive amount of old wood. It may be prevented from doing this by selecting fruiting canes nearest the trunk, thus minimizing the addition of old wood and by occasionally cutting the trunk back to younger wood with fruiting canes. It is sometimes advisable to renew the whole trunk. A shoot which has been produced from near the ground may be allowed to grow for two years to produce fruiting canes. The old trunk may then be cut off

at the ground, thus renewing the whole top. This should only be done, however, when the vine becomes so old that it is making an unsatisfactory growth or when some insect or mechanical injury to the trunk makes it necessary.

Grapes may be pruned any time after the leaves drop in the fall until the buds begin to swell in the spring. Where the vines are seldom injured by the low temperatures of winter, as in the eastern third of the state, the pruning should be done in early spring about March. In other sections of the state where injury may occur, it is well to prune about November in order that the vines may be laid to the ground and covered with three or four inches of dirt.

CURRANTS AND GOOSEBERRIES

The best fruit is borne on one-year-old shoots and on spurs of two- and three-year-old wood. Each year some of the wood over three years old should be removed and six or eight of the most vigorous young shoots left.*

BLACKBERRIES AND RASPBERRIES

These fruits do best in semi-shade as on the north of buildings or where sheltered by trees. The principal pruning should be done in the spring after growth begins. At this time the laterals should be reduced to a length of twelve to eighteen inches. It is also good practice to pinch off the tips of young shoots when they are three or four feet high to induce branching (this does not apply to red raspberries), and to cut out and burn the old plants after the fruit is harvested.

INSECTS AND DISEASES OF THE ORCHARD

There are various kinds of injurious insects and diseases common to fruit plants. Some of them are dangerous only on occasional years or under certain seasonal conditions. Pests of this kind can only be fought to advantage by keeping close watch of the orchard and by acting promptly when they appear. Others come at rather regular intervals every year. Owing to their regular habits it has been possible to devise spray schedules for the different tree fruits, to be applied at definite periods.

*The pruning of currants, gooseberries, blackberries and raspberries is discussed more fully in Extension Circular No. 1230.

The owner of a home orchard should be prepared to combat the diseases and insects that are liable to attack his plants. While some fruits may be grown with a considerable degree of success in certain years without spraying, it may be assumed that the fruit and even the plants will sooner or later be greatly damaged unless protected by sprays or other means. Spraying not only increases the quantity and improves the quality of the fruit, it also prevents certain pests from doing serious damage to the plants.

The actual labor and expense of spraying a home orchard is not great. The equipment necessary need not cost over \$15 or \$20 and it can be used also for spraying the poultry and hog houses. The cost of spray material will be approximately 15c per tree for the season. From two to five applications are necessary, the number depending upon the kind of fruit and upon the season. Two men with a good barrel sprayer, can spray the average home orchard, consisting of 30 to 40 trees, in two hours.

One should realize the possibilities and limitations of spraying. Most fungous diseases multiply and spread by means of small seed-like bodies, known as spores. These spores are carried by the wind, insects and other agencies and deposited upon the fruits, leaves and twigs. If a spore is allowed to germinate it produces a rootlike growth which enters the plant tissues. After the disease has thus gained entrance it develops at the expense of the plant. Sprays are not effective against a disease in this advanced stage. They are effective only in preventing the disease from entering the plant. The principal object in spraying for disease control is to prevent the spores from germinating by keeping the surface of the fruits, leaves and other plant parts covered with the material. Some diseases are controlled by means other than spraying, such as pruning, cultivation, and general orchard sanitation.

Spraying is the only effective means of controlling certain kinds of insects. In general those insects and worms which feed upon the plants by devouring the leaves and fruits must be fought with poisonous sprays, while others such as plant lice, that do damage only by sucking the sap, must be combated with a spray that kills by contact. Spraying to control insects should be supplemented with certain other orchard practices. Cultivation is sometimes very effective in preventing certain insects from transforming from one stage to another in the soil. Pruning makes it possible to do a better job of spraying. Some

insects need weeds, wild plum thickets or rubbish of some kind in which to pass the winter. By destroying such places in and near the orchard, one lessens the liability of infestation the following year.

It is believed that the principal reason why more home orchard owners do not control the insects and diseases is on account of a lack of general knowledge of control measures. Some of the principal spray materials are here described, and their uses given. A brief description is also given of the common fruit pests in Nebraska, together with suggestions for their control.

SPRAY MATERIALS

LIME SULPHUR (SOLUTION)

This is a concentrated solution of lime, sulphur and water. It is used against certain diseases when diluted 35 times and applied as a summer spray. When diluted nine or ten times and applied just before the buds open, it is effective as a contact spray against scale insects. For the small orchard this is probably the most convenient, effective and cheapest spray for some apple and cherry diseases, that can be used. It can be purchased from several reliable manufacturers.

DRY LIME SULPHUR

This is a powdered form used for the same purposes as the lime sulphur solution. It is dissolved in water according to directions on the package and applied as a spray.

BORDEAUX MIXTURE

This is a spray for fungous diseases and consists of—4 lbs. stone lime, 4 lbs. copper sulphate, 50 gals. water. To properly mix it, dissolve the copper sulphate in warm water and dilute it to 25 gallons. In a separate container slack the lime in just enough warm water to make a thick paste, and then stir well and add enough water to make 25 gallons. These two solutions should then be poured simultaneously into the sprayer or a third container. The copper solution corrodes metals and should therefore be handled only in wooden or earthen containers. Bordeaux should be freshly prepared each time it is needed.

SELF-BOILED LIME SULPHUR

This is a spray for diseases of the plum and peach. It may be made by properly mixing 8 lbs. lime, 8 lbs. sulphur and 50 gals. of water. Place the stone lime in a half barrel and add enough warm water to cause it to begin slacking. While the heat of the slacking lime is being spent, stir in the sulphur flour. Keep the mixture well stirred while it is hot, adding a little more water if necessary to prevent baking. When thoroughly mixed, add enough water to make 50 gallons before using. Stir the mixture well and strain thru a fine sieve before filling the sprayer.

ARSENATE OF LEAD

This is the most common form of arsenic for orchard use against that class of insects that do damage by eating the fruit and leaves. It is sold in both the paste and powdered forms. Paste arsenate of lead contains about 50 per cent water and should be used at the rate of $2\frac{1}{2}$ lbs. to each 50 gals. of spray. The dry form should be used at the rate of $1\frac{1}{4}$ lbs. to each 50 gals. of spray. When using arsenate of lead the required amount should be weighed out and stirred in a pail of warm water until it is in suspension before being poured into the sprayer. Arsenate of lead may be used with the above mentioned lime sulphur solutions or with Bordeaux, thus making a combination spray for chewing insects and diseases.

NICOTINE SULPHATE

This material is used primarily for such tender bodied insects as aphids. The commercial form is very concentrated, one-half pint being sufficient to make 50 gals. of spray. A piece of hard laundry soap the size of a hen's egg dissolved in each three gals. of spray causes nicotine sulphate to spread more evenly over the plant and penetrate to and thoroughly wet the insects. When using Nicotine Sulphate in combination with other sprays, soap should not be used.

QUANTITY OF SPRAY MATERIAL NEEDED

An average sized apple tree 18 or 20 years old will require about 12 gallons of the diluted spray material for the four summer applications. Arsenate of lead is usually used at the rate of $1\frac{1}{4}$ lbs. to 50 gallons of spray and lime sulphur solution

at the rate of $1\frac{1}{2}$ gallons to 50 gallons of spray. Thus 50 apple trees will require approximately 18 gallons concentrated lime sulphur solution and 15 lbs. arsenate of lead powder for one season. Average sized plum and cherry trees will require approximately one-half as much material as apple trees.

SPRAY APPARATUS NEEDED

FOR 20 TREES OR LESS

The bucket or knapsack sprayer may be used with a fair degree of success where only a few trees are to be sprayed. They are also convenient for garden use. One should have at least 15 feet of spray hose and an extension rod six to ten feet long. The extension rod may be made from a one-quarter inch gas pipe, and it should have a stopcock at one end for best results. The nozzle should be attached to the extension rod in a

way that will force the spray out at an angle of about 45 degrees. If the nozzle does not have an angle attachment, use a 45 degree elbow or bend the end of the rod. It is important to use a nozzle suitable for spraying trees, one that throws a fine mist.

FOR 20 TO 100 TREES

A single action barrel sprayer (See Fig. 3) is suitable for the average farm orchard. This type of sprayer is usually operated from a wagon or a sled. It is advisable therefore to have twenty-

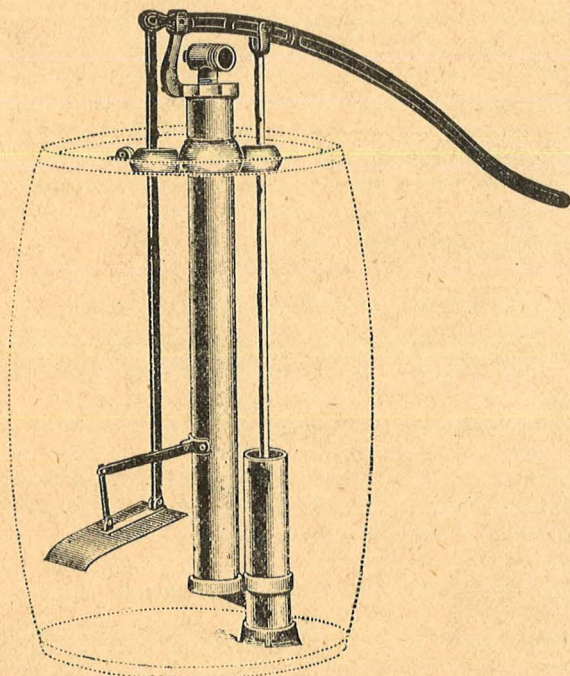


Fig. 3—Single action barrel sprayer.
Convenient type for orchards of 20 to 100 trees.

five feet of spray hose and an extension rod with the attachments recommended above.

FOR 100 TO 250 TREES

A double action, horizontal spray pump (See Fig. 4) has a greater capacity than a single action sprayer. It will maintain good pressure for two nozzles. (See discussion above for hose rods, and nozzles).

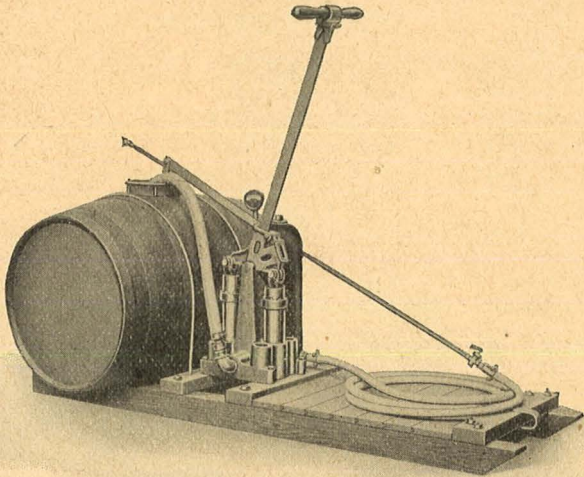


Fig. 4—Double action spray pump, suitable for orchards of 100 to 250 trees.

POWER SPRAYERS

This type of sprayer, using a gas engine as power is needed for commercial orchards or for "spray-rings." Where several home orchard owners, in the same community, enter into the purchase of a spray outfit with a view of spraying their orchards cooperatively, the enterprise is referred to as a "spray-ring." Since power sprayers have a capacity sufficient for ten to twenty home orchards, spray-rings may be organized as an economical and efficient means of spraying several orchards.

METHODS OF APPLYING THE SPRAY

The principal object of spraying is to keep the fruits, leaves and other plant parts covered with spray to prevent insects and

diseases from attacking the plants. This is best done by the use of a fine spray under high pressure and directed at the plant from different sides. It is well to keep the nozzle constantly moving in order to prevent the spray from accumulating until it drips. The nozzle should be attached to the spray rod at an angle of 45 degrees to enable the operator to change the direction of the spray by a twist of the hand.

APPLE DISEASES

SCAB

This disease attacks the fruit, leaves and young twigs. (See Figs. 5 and 6). In orchards that are not sprayed it is not uncommon to find as high as 80 per cent of the fruits affected,

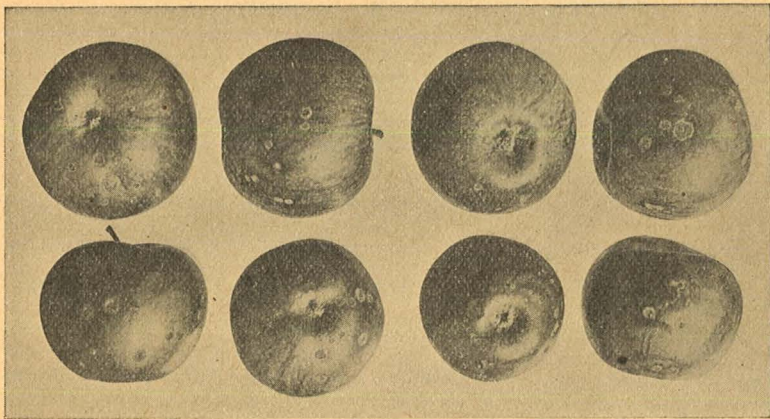


Fig. 5—Apple scab on fruit.

many of them being so scabby, deformed and cracked as to be unfit for use. On the fruit the disease produces the scab spots which vary in size from a speck to one-half inch in diameter. They may vary in color from light gray to black, depending upon their age. The infections on the fruit are only skin deep, but they often prevent the normal development of the apple, causing one side to become dwarfed and often cracked. A high per cent of the affected fruits may drop before they are ma-

ture. The disease attacks the leaves on both sides, forming light brown patches which become somewhat swollen. In severe cases the vitality of the tree becomes weakened on account of the leaves dropping prematurely.

The disease lives over winter on the dead leaves under the trees. About the time the trees begin to grow in the spring the disease becomes active, producing spores which are carried to the young leaves and fruits. Under favorable conditions of temperature and moisture, they germinate to form the characteristic spots on the fruits and leaves. These infections may soon produce summer spores which are capable of spreading the disease to other leaves and fruits. When the weather is cold and damp about blooming time or later, the stems of the young fruits may become diseased, causing most of the crop to drop.

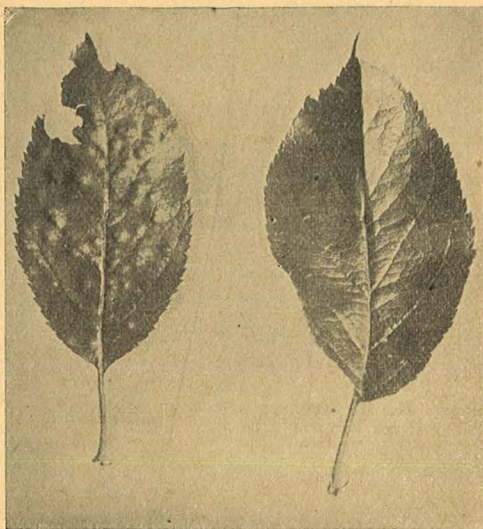


Fig. 6—Apple scab on leaf.

Control—Scab is essentially an early summer disease. It is best controlled by means of sprays. Either lime sulphur or Bordeaux Mixture may be used. The *first application* should be made from two to six days before the bloom opens. The *second application* should be made after most of the bloom is off but before the calyx lobes close. A *third spray* should be made about two or three weeks after the second. If the weather is dry during June and the infection light, the three applications may be sufficient. Under average conditions in eastern Nebraska it is advisable to make a *fourth application* about the middle of July; and on certain years when weather conditions have been very favorable for the scab it may be necessary to make a *fifth application* during August.

BLOTCH

This is a fungous disease which does considerable damage to certain varieties of apples, such as Missouri Pippin, N. W. Greening, Ben Davis, Gano and Duchess. It attacks the fruits, twigs and leaves. On the fruit (See Figs. 7 and 8) it forms blotches somewhat similar to those produced by scab but distinguished from them by their slick surface and starlike appearance. The blotches first appear as irregular masses of dark brown

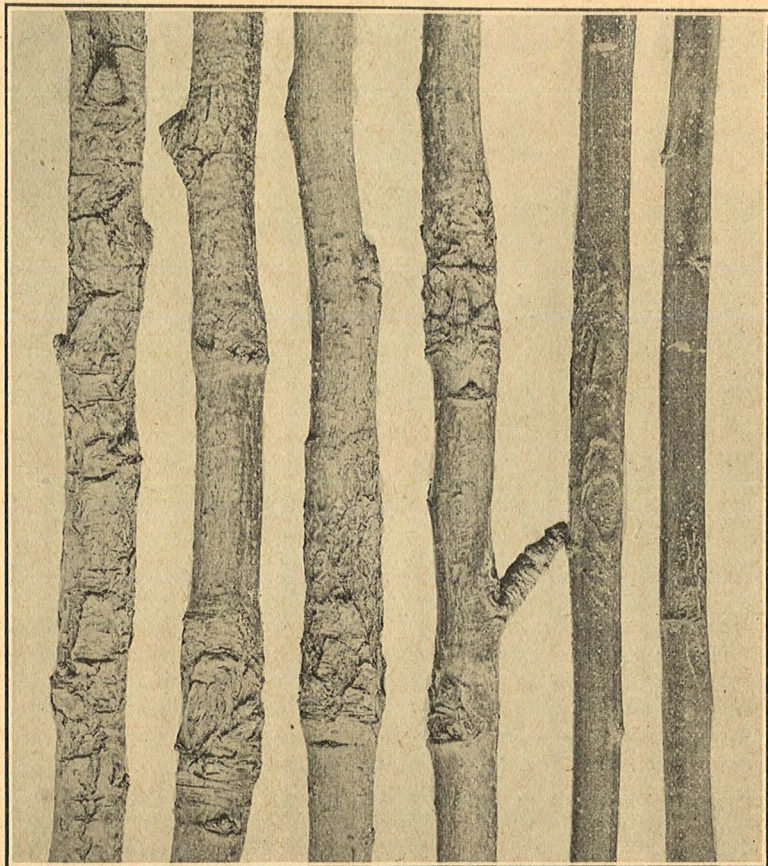


Fig. 7—Apple blotch on twigs.

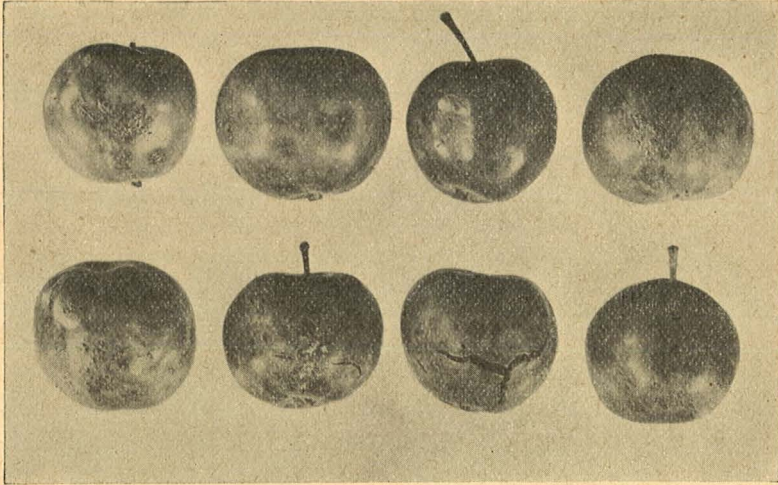


Fig. 8—Apple blotch on fruit.

strands which as they become older, turn almost black with irregular edges. Another distinguishing characteristic of this disease is the presence of small black pimples in the center of the blotch. The deep cracks across the blotches, together with the blotched appearance often renders the fruit unsalable or may even make it unfit for use. In severe cases the fruit may drop before it is mature.

Apple blotch winters over on the fruit spurs, small twigs (See Fig. 3) and water sprouts. The cankers formed on the twigs and spurs may be recognized by the roughened appearance of the bark at the place of infection. These small cankers furnish a source of infection in the spring by producing spores which infect the fruits and leaves. The spores produced on the blotches of the apples in turn infect the twigs causing the cankers which carry the disease over winter.

The small light spots produced on the leaves are not often serious enough to be particularly harmful to the tree.

Control—The most effective means of controlling blotch is to spray with Bordeaux or Lime Sulphur. Bordeaux is better but lime sulphur is satisfactory in mild cases of infection. Unlike scab, blotch does not appear until three or four weeks after blooming time. The *first* spray should be put on about two or

three weeks after the tree was in bloom. The *second spray* should follow the first in two weeks. It is important to prune off as many of the cankered twigs and water sprouts as possible during winter or early spring.

FLYSPECK AND SOOTY BLOTCH

This disease (See Fig. 9) occurs on apples sometimes and

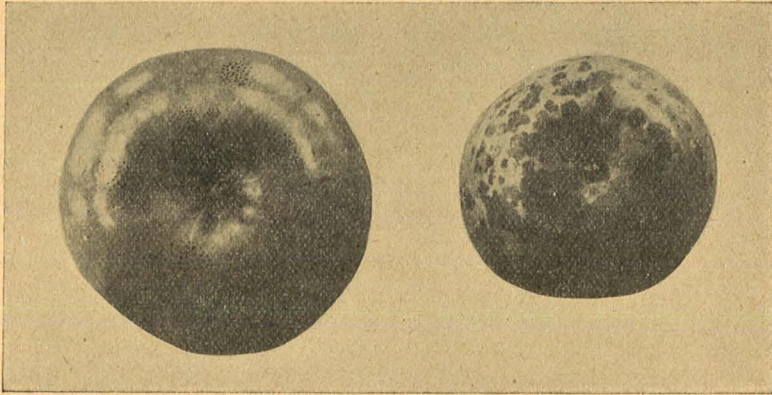


Fig. 9—Sooty blotch.

gives the appearance of flyspecks or if in masses a clouded effect. It is most likely to occur on damp seasons and in low places.

Control—It is one of the easiest diseases to control by means of sprays. The regular applications of Lime Sulphur or Bordeaux used in midseason for scab and blotch are sufficient for its control.

CEDAR RUST

This disease is found in all parts of the state where the red cedar occurs. It attacks the leaves and fruits of certain varieties of apples. Both the red cedar and the apple, or some closely related species like the hawthorn, are required for this disease to complete its life cycle. It winters over on the cedar, producing the characteristic galls (See Fig. 10) or “Cedar

apples." These galls sometimes attain a diameter of one inch by early spring of the second year, and at that time send out long, yellow, jelly-like projections bearing millions of spores. These spores are carried long distances (a mile or more) and germinate on the fruits and leaves of the apple. The infections on the leaves cause orange colored spots on the upper surface and cup-like projections on the under side. The infections on the apples somewhat resemble the spots on the leaves except they are larger. In severe cases there may be so many leaf spots as to weaken the vitality of the tree.

Control—Spraying is not considered a practical means of controlling cedar rust. Where it is feasible to either destroy the cedar trees or keep the galls picked off before they produce spores, this is the most effective means of control. Where red cedars are in abundance, one should avoid planting such susceptible varieties as Wealthy, Jonathan, York, Minkler and most of the crabs.



Fig. 10—Galls of the cedar rust.

BLISTER CANKER*

This disease has killed more apple trees in Nebraska than all others combined. It causes the large cankers with the characteristic spots (See Fig. 11). They usually appear at the base of the large limbs or on the trunk. The cankered area first appears as a patch of dead bark, brownish in color, and slightly depressed below the healthy tissue. As the disease reaches a more advanced stage, the canker takes on a blistered or mottled appearance, forming the spore-bearing spots. These spots may be light in color and depressed or they may be almost black and protrude above the surface, depending upon the time of year and the age of the canker.

*Bulletin No. 161—"Methods of Controlling Blister Canker", will be sent upon request to any county extension agent or the Agricultural College, Lincoln.

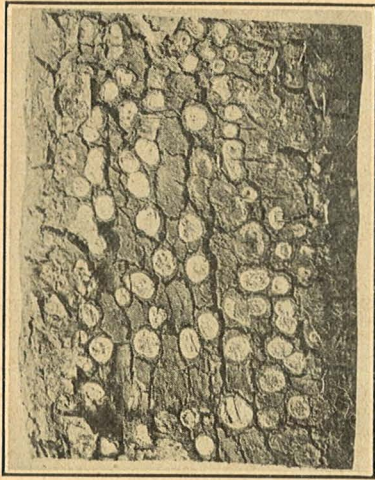


Fig. 11—An advanced stage of Blister Canker. This disease may be distinguished from others by the characteristic spots in which the spores are borne.

Spores are produced in abundance on the cankers mentioned above. When they are carried to neighboring trees by means of the wind, birds, insects, or pruning tools, new infections may occur. The spores can cause infection only when they come in contact with an open wound, such as broken branches, growth cracks, or unprotected pruning wounds. When the disease gains entrance it works rapidly in the heartwood of the trunk and branches. An single infection may soon result in a discoloration of the inner wood of the trunk and most of the branches. While this discoloration is an indication of the presence of the disease, it may not come to the surface and form a canker for several seasons. When the

disease comes to the surface it kills the live, active tissue just beneath the bark. As a canker becomes larger, the trunk or branch upon which it is located may be killed by being girdled.

Control Measures—The most effective means of combating blister canker is to use cultural practices designed to keep it out of the orchard. Spraying will not control the disease, though the application of Lime Sulphur and Bordeaux may prevent the germination of some spores. The following suggestions are offered for preventing blister canker and for dealing with diseased trees:

1. Avoid planting such susceptible varieties as Ben Davis and Gano. They are the first varieties to take the disease and the presence of cankers on them furnishes a constant source of infection to the other more resistant varieties.
2. Practice methods of culture that will keep the trees growing moderately. A tree that has been checked in its growth by defoliation from disease, blue grass sod, lack of moisture or any other cause, is much more likely to be attacked by canker than one that is in a thrifty condition.

3. Prevent open wounds as much as possible. Any heavy pruning that is needed should be done before warm weather of spring begins, since there is less danger at this time of infection thru pruning wounds. Paint all larger pruning wounds as soon as dry with white lead thinned with linseed oil.
4. A tree infected with blister canker may bear several crops before it dies. Any medium sized limb with a fruiting canker should be cut off close up to the trunk and burned. Cankers on the larger limbs and trunk should be treated to prevent the spores from being carried to other trees. This treatment may consist of shaving away the spore bearing tissue and painting the wound, or in covering the canker over with asphaltum warmed and thinned with a little gasoline or linseed oil.
5. All cankered trees and branches should be burned as soon as they are removed. If left in or near the orchard they will serve as a source of infection for several months.
6. Trees that are known to have canker present in the heartwood should neither be "dehorned" nor pruned heavily. This causes the disease to come to the surface in the form of larger cankers.
7. When spraying the trees for other diseases direct the spray against the trunk and larger branches in order to cover any wounds that may be exposed.
While blister canker is known to have killed thousands of apple trees in Nebraska the past ten years, the authors believe that the selection of resistant varieties and judicious care will make the damage from it a much less serious matter.

FIRE BLIGHT

Fire blight or twig blight, is a bacterial disease which attacks both apple and pear trees. It is easily recognized in the orchard by the characteristic browning and blackening of the leaves and twigs. Twigs attacked by it hold their leaves after the others have dropped and the bark becomes depressed. The large branches and even the trunk may become affected thru diseased fruit spurs and water sprouts, causing large areas of dead bark. The bacteria which cause the disease, live over winter at the junction of the live and dead wood of affected branches and in the cankers on the body of the tree. It is

doubtful whether or not the bacteria can survive the winter in fruit spurs, water sprouts and twigs that are less than three-eighths of an inch in diameter. Where they do hold over they become active in the spring and are carried, mostly by means of insects, to the flowers, leaves and young twigs where they gain entrance to healthy tissue.

Control—Fire blight is not affected by sprays. It should be cut out in late fall or early spring. All affected branches, twigs, and bark should be burned. In cutting out fire blight care should be taken not to spread the disease to healthy wood. The pruning tool should be frequently disinfected by wiping it with a cloth saturated with a solution of Corrosive Sublimate, 1 part to 1000 parts water. Where blight threatens to do serious damage it is well to keep close watch of trees during mid-summer and cut off any affected twigs and water sprouts to prevent the disease from getting into the large limbs and trunk. Rapid wood growth favors the development of blight. Jonathan, York and Yellow Transparent are more susceptible than most other varieties.

APPLE INSECTS

CODLING MOTH

This is probably the most common insect pest with which apple growers have to deal in the central west. The different stages of its development are commonly referred to as larval (worm stage), pupal (before emerging from its silken cocoon) and adult (moth stage). The moths begin to appear a week or two after blooming time. They are seldom seen in the orchard, being small and grayish-brown in color. The eggs are deposited one in a place on the leaves and young twigs. The time required for the eggs to hatch is from one to two weeks depending upon the temperature. The larvae or young worms, soon find their way to the young apples. They eat into the fruits, usually burrowing about the core, emerging about three weeks later as full grown worms one-half to two-thirds of an inch long. These full grown worms upon leaving the fruit seek a protected place and spin silken cocoons in which they transform to the pupal stage and emerge about three weeks later as moths. Thus the second brood of moths usually appear about two months after blooming time or during the month of July. A partial third brood may occur if the summer has been unusually hot and dry. The broods over-lap somewhat, causing a tendency for the appearance of worms to be continuous. The second and third

broods pass the winter in their cocoons, hidden either under the bark or in convenient trash piles.

It will be noted that all the damage is caused by the worm stage, that the worms are present from May until the fruit is harvested and that the worms eat their way into the apples. These facts concerning the habits of the codling moth are important in determining the control methods.

Control—Arsenate of lead applied as a spray is the most effective means of controlling codling moth worms. The applications should be made approximately as follows: 1st, immediately after the bloom drops; 2nd, about three weeks later; 3rd, about the middle of July; and 4th, (if needed) in August. Two and one-half pounds of the paste Arsenate of Lead or one-half this amount of the powdered form should be used for each fifty gallons of spray.

PLUM CURCULIO

This insect is a snout beetle (See Fig. 12) which does considerable damage to such fruits as apple, peach, apricot, pear, plum and cherry. It is especially injurious to the plum and peach. The beetle appears in early spring. It attacks the apples when they are one-half inch or more in diameter. The punctures are made for feeding purposes and for depositing eggs. Some of the fruits drop and others become knotty and misshapen as they develop. The punctured places appear at harvest time as small scars, which detract from the appearance and keeping qualities of the fruit. The worms develop in the fruit and later go to the ground where they make earthen cells in which they transform to the beetle stage.

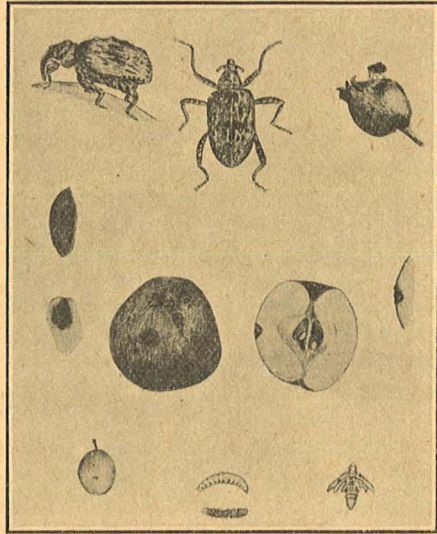


Fig. 12—Plum curculio.

Another brood of beetles thus appears in mid-summer and after feeding upon the fruits, hibernates over winter in such convenient places as fence rows, plum thickets and trash piles.

Control—Arsenate of Lead applied with other sprays is partially effective as a control measure (See spray schedule). Destroy wild plum thickets and other places where the curculio is apt to hibernate. Where clean culture in mid-summer is feasible, many of the pupae may be destroyed by this method.

OYSTER SHELL SCALE

This pest is found in some orchards in Nebraska. It is a sucking insect that may greatly weaken a tree, if present in sufficient numbers, by sucking the sap from the young branches. Its presence in an orchard may be determined by examining the bark closely of one to three year old branches. The old scales usually adhere to the bark of older wood but most of the damage is done on the younger twigs since the young insects always seek the more tender wood. The scales are about one-tenth of an inch long, dark gray in color, and shaped somewhat like an oyster's shell. (See Fig. 13).

Control—Commercial Lime Sulphur solution, diluted ten times, applied just before the leaves come out in the spring, is the most effective way of controlling oyster shell scale. Every effort should be made to drench the bark of all twigs and branches. It should not be necessary to spray each year for this pest. By examining the bark of young wood and water sprouts, a year or two after spraying for scale, one can determine the necessity for further treatment.

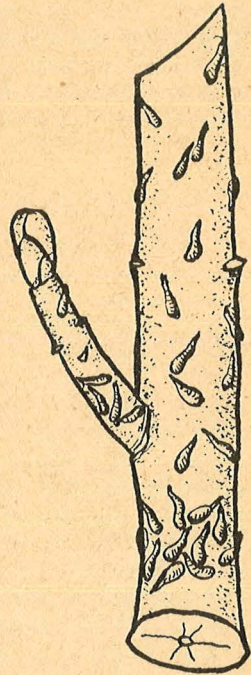


Fig. 13—Oyster shell scale.

SPRING CANKER WORM

The spring canker worm may be recognized by its "measuring" habits of moving and also by the way it doubles up and suspends itself on a thread in mid-air when disturbed. These worms appear in enormous numbers on certain years about the time the leaves are developing. They devour the leaves, leaving

only the veins and midribs. The entire orchard may be defoliated within three or four days.

Control—Arsenate of Lead applied promptly when the worms appear will prevent further damage. A pre-bloom spray as for scab and curculio, containing Arsenate of Lead, will control this pest. Summer cultivation is recommended where the worms have not been controlled by spraying.

TENT CATERPILLAR

The eggs of the tent caterpillar pass the winter. When they hatch in early spring the worms or caterpillars feed upon the young leaves and soon begin a web-like nest in a crotch of the tree. The web serves as a retreat for the worms when they are feeding upon the surrounding foliage.

This pest is very common in the central, northern and western parts of the state and may be found upon many trees

SPRAY SCHEDULE FOR APPLES AND PEARS

	Time of Application	Materials to Use	Pests Controlled
1st [†] spray	2 to 6 days before flowers open. See Fig. 15	Lime-sulphur solution 1½ gallons. Lead arsenate 1¼ lbs. to 50 gallons water.	Scab, curculio, Spring canker worm, Tent caterpillar.
2nd spray	Immediately after flowers drop. See Fig. 16	Same as for 1st spray.	Pests as above and Codling moth worm.
3rd spray	2 to 3 weeks after 2nd spray. See Fig. 17	Lime-sulphur solution 1½ gallons, Lead arsenate 1¼ lbs. to 50 gallons water.	Scab, blotch,* Sooty blotch, Codling moth, curculio.
4th spray	About the middle.	Same as for 3rd spray.	Scab, blotch, Sooty blotch, Codling moth, curculio.

†Where scale insects are serious apply Lime Sulphur 1 gal. to 9 gals. water just before leaves appear.

*For severe infection of blotch use Bordeaux 4-4-50 instead of Lime Sulphur solution at the third application and give an additional Bordeaux spray two to three weeks later. Also use Bordeaux for the regular 4th spray.

other than the apple. It is seldom found in orchards that are regularly sprayed with Arsenate of Lead.

Control—The webs may be cut off and burned or fired with a torch when the worms are inside. Spray with Arsenate of Lead as for curculio and codling moth.



Fig. 14—Apple twig injured by Buffalo tree hopper. A—Injury on young wood. B—Scars on older wood.

BUFFALO TREE HOPPER

Crescent shaped scars on the branches (See Fig. 14) indicates the presence of buffalo tree hopper. It is an insect which deposits its eggs in the young wood. The wounds made in depositing the eggs constitute the damage done by the pest, since it feeds only upon grass, weeds and similar vegetation. Where a tree's branches are literally covered with the scars it may be severely weakened.

Control—All weeds and grass near the trees should be mowed frequently. This is especially important as a means of protecting young apple trees. Owing to the susceptibility of young trees to this pest it is advisable to give clean culture or to grow only cultivated crops between the rows for the first six or seven years.

DISEASES AND INSECTS OF THE PEAR

The pear is subject to many of the pests that attack the apple, the most common ones being, scab, blight, codling moth, curculio, canker worm, oyster shell scale, buffalo tree hopper and tent caterpillar. The treatment is the same as that given for the apple. Blight is more severe, however, on the pear and for this reason it is considered advisable to check the growth of the trees even

to the extent of allowing blue grass sod to grow around them.

BROWN ROT

This fungus is more destructive than any other to such fruits as plum, peach and apricot. It is the disease responsible for the rapid rotting of the fruit about the time it ripens. The infection of the plums usually occurs from the time the fruit is half grown until it is ripe. The first appearance on the fruit may be noted as a small circular, grayish brown, decayed area, usually at an insect puncture. The decayed spot becomes rapidly larger, and gray spore bearing tufts appear on the surface. The fruits that have been rotted and allowed to hang on the tree, as well as the ones on the ground, serve as a source of infection the following year.

Control—Self-boiled Lime Sulphur is effective against brown rot. The first application should be made as soon as the smooth surface of fruits are exposed; the second, three weeks later; a third in early July. It is important to include Arsenate of Lead in each of the three applications to prevent the curculio from puncturing the fruits. Destroy mummied fruits. Cultivate in early spring.

PLUM POCKETS

This disease is a fungus which causes the plums to de-



Fig. 15—Flower cluster of apple at proper stage for first spray. Flowers have not opened.



Fig. 16—Proper stage of apple for second spray.



Fig. 17—Proper stage for third spray.

velop abnormally. (See Fig. 18). The fruits when attacked by it usually become elongated and enormously swollen.



Fig. 18—Plum Pockets. Note normal and affected fruits.

The interior of the fruit is usually hollow and the seed only partially developed. The disease is said to winter over on the twigs, where it develops in early spring, gaining entrance to the young fruits through the pistils of the flowers. Wormy fruits usually begin to ripen prematurely and drop to the ground. Where the curculio is present, it is highly unsatisfactory to attempt to grow plums unless they are sprayed.

Control—Arsenate of Lead should be used as a spray (See schedule). Spraying should always be supplemented by culture in mid-season, in the control of this pest. Wild plum thickets near the orchard should be destroyed.

Control—The Lime Sulphur sprays are fairly effective in controlling plum pockets. (See spray schedule). Diseased twigs should be pruned off in early spring, before growth begins, and burned.

PLUM CURCULIO

This beetle (see description under apple insects) is particularly severe on the plum. It is not uncommon for a single fruit to have six to eight crescent shaped wounds where eggs have been deposited. The eggs

PLANT LICE

are laid any time after the fruit is formed until it is practically grown. When the egg hatches the worm is within the plum. They multiply very rapidly. A leaf infested with plant lice will soon begin to roll or curl up, thus making it rather difficult to use a contact spray.

Control—Nicotine sulphate diluted about 800 times and applied as a spray will kill plant lice if applied before the leaves curl up. A piece of laundry soap the size of a hen's egg heated in a little water and added to each three gallons of spray, will cause the material to spread better.

SPRAY SCHEDULE FOR PLUMS

	Time of Application	Materials to Use	Pests Controlled
1st spray	As soon as shucks have dropped.	Self-boiled lime sulfur or lime-sulphur solution 1½ gallons. Lead arsenate 1¼ lbs. to 50 gallons water.	Curculio, Brown rot.
2nd spray	About 3 weeks later.	Same as 1st spray.	Curculio, Brown rot.
3rd spray	About the middle of July.	Self-boiled lime-sulphur	Brown rot.

If "Plum pockets" has been present the previous season, an additional spray consisting of Lime Sulphur solution, 1½ gals. to 50 gals. water should be made just before flowers open.

DISEASES AND INSECTS OF THE CHERRY LEAF SPOT

Cherry leaf spot or "shot hole," as it is sometimes called, is a foliage disease. It appears first in early summer as small purplish spots on the upper surface of the leaves. The spots become brown in color and later holes are formed by the diseased area dropping out. The whole leaf may turn yellow and drop. The disease winters over on the dead leaves, producing spores in the spring capable of infecting the new foliage. Summer spores are formed on the infected leaves which serve to spread the disease in mid-summer. Under favorable conditions, as after damp cloudy weather, the disease may become so severe as to completely defoliate the tree in mid-summer. Young trees are particularly susceptible to damage from leaf spot.

Control—Commercial lime-sulphur, $1\frac{1}{2}$ gallons to 50 gallons water or Bordeaux Mixture, will successfully control this disease. The first application of spray should be made as soon as the husks of the flowers drop, the second about three weeks later, and the third as soon as the fruit is harvested.

CURCULIO

The curculio does its chief damage to cherries by laying eggs in the young fruits, causing wormy cherries. (See discussion under apple).

Control—(See spray schedule for cherries). Clean culture in mid-season is also advisable.

SLUGS

The larval stage of this insect may appear upon the foliage in mid-summer and do some damage by eating the outer surfaces of the leaf. In this stage it is a small dark green, snail-like insect.

Control—Arsenate of Lead, $1\frac{1}{4}$ lbs. to 50 gals. water applied when it appears is effective. Trees sprayed for curculio are not apt to be attacked by slugs.

SPRAY SCHEDULE FOR CHERRIES

	Time of Application	Materials to Use	Pests Controlled
1st spray	Immediately after shucks have dropped.	Lime sulphur $1\frac{1}{2}$ gallons. Lead arsenate $1\frac{1}{4}$ lbs. to 50 gallons water.	Curculio, Leaf spot, Brown rot.
2nd spray	About 3 weeks after 1st spray.	Same as for 1st spray.	Curculio, Slug, Leaf spot, Brown rot.
3rd* spray	After fruit is harvested if leaf spot is present.	Lime sulphur $1\frac{1}{2}$ gallons. to 50 gallons water.	Leaf spot.

*This application is not necessary every year. Bordeaux Mixture 4-4-50 may be used instead of Lime Sulphur.

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