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ORCHARDING

INFORMATION
CONCERNING PLANTING,
PRUNING AND SPRAYING

Prepared by

Professors Wendell Paddock and V. H. Davis,
College of Agriculture, Ohio State University,
Columbus, Ohio.

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• THIS IS NOT A WESTERN ADVERTISING SCENE, BUT ONE
OF A TYPICAL CENTRAL STATES ORCHARD.

LOCATION

The season of 1910 has demonstrated again the fact that both altitude and proximity to large bodies of water should be considered in the location of orchards. A splendid crop of all kinds of fruit was harvested in the fruit belt along the lakes and in the hilly section. There was, however, in many instances, a sharply defined frost line in many of the hill orchards, below which there was little or no fruit. But in other localities, where the land is much lower and level as well as being away from the influence of water, there was an almost universal failure in the fruit crop. This does not indicate, however, that the greater portion of this area is not adapted to fruit growing, for it is, but that when one has a choice of locations the two features mentioned should be taken into account. The lower, level lands that are some distance from large bodies of water are more likely to suffer from late spring frost than is a more elevated and broken country. Cold air settles to the lower places while the warm air rises. Thus, the tops of hills frequently escape frosts that are disastrous in effect in the lower land.

LAND

Most any land that will grow good farm crops will usually grow fruit, but preference should be given to loamy soils because they are much easier to work and to keep in good tilth. Peaches usually do best on the sandier soils while pears and quince appear to do best on heavier soils. Grapes usually thrive best on limestone soils.

The one feature to be noticed in particular is drainage. Orchard land should have good drainage as fruit trees and plants cannot thrive in wet land. If the land is not well drained naturally, tiling must be resorted to.

Soil that is in a good state of fertility is much to be preferred for orchard purposes as the trees are to occupy the land for a period of years and orchard trees have been found to be harder on land than is the continuous cropping of wheat. Much of the hill land is low in fertility, but at the same time, it is better adapted to orchard purposes than to anything else and if proper cultural methods are followed, the soil can be greatly improved. Some of our best paying orchards are located on land of this character.

A TYPICAL HILL ORCHARD OF THE OHIO RIVER COUNTRY.

PREPARATION OF LAND

The one thing that land is liable to be lacking for orchard purposes, is decaying vegetable matter. Land can be fitted best for the trees, perhaps, by plowing under a good crop of clover. If time will permit, the clover may be followed to advantage with corn or potatoes. The final preparation of the land should be the same as for any other intensive crop; deep plowing and thorough pulverizing with disc and spring-tooth harrows.

Occasionally young trees succeed well when planted in sod, but these cases are thought to be exceptional. This method of planting is advisable on very steep hill-side land when plowing is difficult and there is danger from washing.

The distance apart at which the trees are to be planted will depend upon the character of the soil, the kind of fruit, and the varieties. Vigorous growing varieties of apples, as the Baldwin, should be planted 40 feet apart each way if the soil is rich. Such trees will not grow so vigorously upon the lighter soils, particularly if cultivation cannot be given. Other varieties, as the Oldenberg or Transparent, never make large trees, consequently they may be planted as close as 25 feet. Pears are planted 20 to 25 feet apart, while peaches require a distance of 18 feet each way on strong land.

INTER-PLANTING

Where trees are planted at the maximum distance it is often a good plan to plant a tree of an early maturing variety between each two trees in the row and between each two rows of trees. This arrangement places a tree every 20 feet each way. The experience has been that the inter-planted trees or fillers will produce several paying crops before there is any injury from crowding. The fillers must be cut out, however, at the first sign of crowding lest injury result to the permanent orchard. Such varieties as the Oldenberg, Transparent and Wagener are recommended for fillers.

The practice of using stone fruits for fillers in the apple orchard is not usually considered wise since it interferes materially with the best orchard management. Small fruits of all kinds are often inter-planted in young orchards with good results.

In all cases where fillers are used an extra amount of plant food must be supplied to replace the large amount that has been used as a result of the intense cropping.

INTENSIVE FRUIT GROWING. DWARF PEARS INTERPLANTED WITH CURRANTS.

LAYING OUT THE LAND

One of the simplest methods of laying out the orchard for planting is to set stakes the proper distance apart along two sides and across the middle. A dead furrow is plowed for each row then the field is cross-marked in the same way but with a single furrow. The trees are set at the intersections of the furrows, and with a little care, straight rows are secured.

PLANTING

If the soil is mellow, and prepared as above, very little digging will be required; but if the ground is compact, a hole considerably larger and somewhat deeper than is required simply to hold the roots, should be dug. The roots should be spread out naturally without being bent or twisted and the tree should be set from one to two inches deeper than it stood in the nursery row. Mellow top soil should be filled in around and among the roots and firmly packed so that no air spaces are left. A few shovels full of loose earth should be placed around the tree after the hole is filled so as to form a mulch. Straw or manure may be used for this purpose but care should be taken to see that manure or fertilizer does not come in contact with the roots.

The date at which the planting is done will depend upon the location and upon personal preferences. Fall planting may be practicable in most any part of the State of Ohio the great objection being that trees have to be carried through the winter where they are exposed to the rigors of weather before they are established in the ground. The disadvantage of spring planting is the liability of cold, wet, backward weather making the work late. Nursery stock is liable to become dried out or the buds may start

if held too long, thus resulting in many dead or weak trees. Time can no doubt be gained by planting in the fall, but oftentimes best success attends spring planting providing the trees can be planted in first class condition.

VARIETIES

The selection of varieties is largely a local question and should be studied with care for each particular location. There are two well defined fruit belts in this general region where different sets of varieties are found to succeed best. Then, aside from the question of climate, the type of orcharding that one is to follow will make a vast difference in the kinds of fruit to be planted. The large commercial orchardist who is not concerned particularly with local markets will plant only a few varieties and these will mostly be of winter sorts. On the other hand, if the markets are close at hand, a large number of kinds may be desirable and those that ripen in summer and fall may be profitable.

A few of the standard varieties of apples that have been found to succeed in the northern fruit belt are the Baldwin, Rhode Island Greening, Grimes and Jonathan for winter, and Transparent, Maiden Blush, Oldenburg and Wealthy for summer and autumn. The standard winter varieties for the southern section are the Rome, Grimes, Jonathan, York, Gano or others of the Ben Davis family. Early varieties for this locality may be the same as given above. A larger number of kinds than is given in this list will be desirable in some instances.

The Standard varieties of Sour Cherries are Early Richmond, Montmorency, Dyehouse, and English Morello. The sweet cherries are Windsor, Governor Wood, Ida, and Black Tartarian.

The following peaches are standard varieties, listed in the order of ripening: Carman, Early Crawford, Champion, Fitzgerald, Elberta, Late Crawford, Smock.

Pears: Bartlett, Tyson, Seckel, Sheldon, Anjou, Kieffer.

Plums: Moor Arctic, Bradshaw, Lombard, Italian Prune, Monarch, Shropshire Damson.

NURSERY STOCK

The place where nursery stock is grown makes no difference in the future tree. Trees that are grown in the southern states are just as good for planting in the north as those which are home grown. However, preference should be given to local nurseries, other things being equal, for the reason that our nurserymen have more at stake in giving residents of the state a square deal in every respect than do the nurserymen of distant states.

The age of trees to be planted is quite important. As a rule yearling trees of all kinds are best if those that are well grown can be secured. This is particularly true of the stone fruits, since older trees are very apt to fail to grow. Any northern nurseryman should be able to supply good yearlings of this class. It is more difficult to grow good yearling apples and pears in this climate; however, certain nurserymen are evidently meeting with success in producing trees one year from the bud that are large enough for planting. In any event, apples and pears should never be more than two years of age when planted and they

should be grown with low heads in the nursery. The difficulty in the past has been that buyers have insisted upon large, handsome trees and in order to meet this demand, the nurseryman has been compelled to trim the trees up from the bottom and thus force a vigorous growth. Such trees are usually headed too high to meet present-day demands. It is impossible to force suitable scaffold limbs lower down, consequently we must take the trees as they have been headed in the nursery. It used to be thought that orchard trees should be headed 5 or 6 feet high in order that cultivation might be given. This is now known to be an error, as the great majority of growers in localities where the most intensive cultivation is given head their trees very close to the ground. With the yearling tree, the scaffold limbs can be placed at any point on the main trunk desired.

HEELING IN TREES

When the trees come from the nursery great pains should be taken to see that they do not become dried out, which means they must never be exposed to the air any longer than is absolutely necessary. If they are received several days before they can be planted, the boxes or bales should be unpacked, the trees separated in the bundle and promptly heeled in. Heeling in consists in placing the roots in a trench 12 to 14 inches deep which is preferably east and west and inclining the tree sharply to the south. The trees are spread out in this trench and fine soil worked in all about and among the roots. If the trees are to be kept in the trench over winter, the earth covering should be thrown well up on the bodies of the trees.

TRAINING YOUNG TREES

The training at planting time consists in pruning back the roots to stubs about 6 inches in length and cutting off any bruised or torn parts and also in thinning out where they are too thick. The yearling apple tree or pear tree will be unbranched, hence the pruning of the top will simply consist in cutting back the whip a certain distance, depending upon the height of the future head. If the first scaffold limb is to be formed about 24 inches from the surface of the ground, the top should be left about 36 inches in length. This will give ample room for 3 or 4 main branches.

In the case of the stone fruits the yearling trees will be more or less branched. Training consists in first cutting off the top to a length of about 18 or 20 inches, then reducing all the branches to spurs one bud in length. In cases where two-year old apple or pear trees are planted, the first branches are already formed and we must select our scaffold branches from among them. From 3 to 5 branches will be saved to form a future frame-work of the tree and the rest may be removed entirely. The selected branches should be spaced evenly about the trunk so as to produce a well balanced top. At the same time get as much distance between the individual branches upon the trunk as possible. These selected branches are now cut back to about 14 inches in length. It will be seen that the system of trimming advocated removes the central shaft or leader. It is quite necessary now-a-days, since such thorough spraying is demanded, that our trees be compact and close to the ground. This cannot be accomplished with the

"two storied" tree. The second pruning, a year later, will consist in selecting, on the average, two further scaffold limbs on each of the original ones, one at the end and one near the trunk, and cutting them back to a length of about 14 inches. All the rest may be removed. This method of training is continued through the first three or four year's growth when the principal frame work will be completed and a stout, compact tree, will result. If the future pruning is intelligently done there will never be any need for a prop or an excuse for broken branches. If yearling apple and peach trees have been planted, the training after the first year will be just the same as has been described. With the yearling, however, it will be possible to get the branches close to the ground and to have a greater distance between the scaffold branches upon the main trunk. If the branches are spread out over a distance of only 3 or 4 inches when the tree is planted, it will mean that they will apparently come out from the same plane when the tree reaches maturity. They now begin to crowd and an injury to some of them is bound to result. Hence, the desirability of having a considerable distance between the first branches upon the trunk. The future pruning of such a tree will consist principally in thinning out the branches where they become too thick and taking out those branches which tend to form crotches or to interfere with other branches and to head back the very vigorous growths. If this is done annually the work of tree pruning will be reduced to a minimum. If neglected even for one season the trees are liable to get out of shape and much more work is required to bring them into condition.

CULTIVATION

The method of sod mulch as compared with the close cultivation with cover crops is receiving much attention at the present time. Personally, we believe that in many instances the same ends can be secured by either system. However, it is much easier to neglect an orchard that is given over to sod than is the case where cultivation is given. We would certainly give the young tree thorough cultivation for it is difficult to imagine that a tree, particularly when it is young, is different in its requirements from any other of our hoed crops. After trees have made several years growth, it may be desirable in some cases to seed the land and return all of the crop thus grown to the trees in the form of a mulch. In the case of old orchards that are now growing in sod and are producing satisfactorily the ground should be undisturbed. If not productive, one should not hesitate to plow the land, keep it clear of weeds by frequent cultivation up to the latter part of July, then plant to clover. The clover will take up the surplus moisture and thus aid in ripening the fruit and wood. It will form a cover to the land during the winter and when plowed under in the spring will afford an immense amount of organic matter, besides adding a store of plant food. In the more hilly section cultivation is out of the question, consequently the land must be kept in sod. The grass that is grown between the trees should be supplemented with liberal amounts of straw, weeds or stable manure, and in some instances it will be found feasible by the use of the disc to get a good stand of clover started. All too often the sod mulch is taken to mean sod neglect and poor crops of small fruit result. Everything that is grown on the land should be left to mulch the trees and much additional material will be required to make the system a success.

RENOVATING NEGLECTED ORCHARDS

In these days of insects and plant diseases the numerous small farm orchards are not producing the fruit that they once did and many of them are going into a state of decay. This condition has resulted in a greatly lessened annual output for the state. While this neglect has been going on for years, many of these old trees are still vigorous and if proper methods were adopted could be made to produce paying crops for years to come. The first thing to do will be to give the tree a systematic pruning. This will consist in cutting out the dead and broken branches, thinning out where they are too thick and cutting back those limbs that are too tall to be reached easily with the spray. There is no general system for pruning a neglected tree that can be described, but pruning in any event does not mean skinning up the trunks and branches from the bottom. Rather the pruner should begin at the outer ends of the limbs and work backwards, thinning out where too thick and keep bearing wood as low down on the branches and trunk as possible. In cutting off branches, stubs must never be left but the cuts in all cases must be just above a lateral branch or bud.

If the trees are crowded in the orchard some of them must be removed in order to give those which remain the requisite amount of sunlight, plant food and air.

The next attention should be given to the land itself. If it has been long in sod, it may in some cases be desirable to break it up with the turning plow, when clean cultivation can be given. In other cases liberal dressings of stable manure may suffice.

Commercial fertilizers can usually be used to advantage in most any orchard.

The next step in renovating the old trees is systematic spraying, which is described below.

PROFESSOR WENDELL PADDOCK.

So much has been said and written about the necessity for spraying, and the lesson has been so strikingly demonstrated so often and so generally, that it hardly seems necessary to emphasize this phase of the question in a pamphlet of this kind. Many persons may be found in almost every community who have demonstrated repeatedly that spraying is not only profitable, but absolutely necessary for the production of good fruit.

There are two classes of parasites attacking fruit crops, insects and diseases. Any material used to destroy insects is called an insecticide. If used to destroy diseases it is known as a fungicide.

Insects are divided into two classes, biting or eating insects, and sucking insects. Insecticides used for their destruction are likewise divided into two classes: stomach poisons for the eating insects such as worms and slugs, and contact poisons for the sucking insects such as the plant lice and scale.

Diseases are harder to combat because harder to see and understand. Their deadly work may be largely done before we are aware of their presence. Treatment must be of such a nature as to prevent infection. Few diseases can be cured once they have gained a foothold in the tissues of the plant.

PICKING CHERRIES.

SPRAYING MATERIALS

Spraying solutions must be properly made in order to be effective. The following are the common materials used, with methods of preparation.

PARIS GREEN. This is the oldest and one of the best of the arsenical poisons. It is used at the rate of from 6 to 10 ounces to 50 gallons of water or Bordeaux. When used in water alone, 2 to 3 pounds of fresh lime should be added to 50 gallons; the powder should be made into a smooth paste with a little water before being added to the spray tank.

ARSENATE OF LEAD.—This material usually comes in the form of a paste, which should be thinned with small quantities of water before being added to the tank. This poison is now generally considered superior to Paris green for all purposes where a stomach poison is wanted. Three to five pounds to 50 gallons of water, Bordeaux or lime-sulphur is the common formula used.

KEROSENE EMULSION. This kerosene is seldom used pure, but is made into an emulsion with water and soap. Boil one half pound of soap in one gallon of soft water. Remove from the fire and add two gallons of kerosene, stir vigorously for fifteen minutes, when a creamy emulsion will be formed which may be kept indefinitely if sealed. When ready to use, warm and dilute to the desired strength. For soft bodied insects on growing plants, one gallon to 20 to 25 of water will usually be the proper strength. For scale insects on dormant plants one gallon to ten of water may be used.

LIME-SULPHUR. This is now considered a standard wash for the scale insects and moreover is an excellent

fungicide which promises to largely replace Bordeaux mixture. Formulas for lime-sulphur upon growing plants are just now being worked out but it will be safe, for the beginner at least, to depend upon Bordeaux as the principal fungicide for the present.

There are three forms of this material now recommended. The home boiled is prepared as follows:

15 pounds sulphur,
15 to 20 pounds caustic lime
50 gallons of water.

Slake the lime in a small quantity of hot water, gradually adding the sulphur and stirring. Increase the water to 12 or 15 gallons and boil one hour. Dilute to 50 gallons and spray. This form is now being largely replaced by the commercial form, which is made in the same general way, but upon a large scale and is bought ready to dilute and use. For scale insects it should be diluted at the rate of one gallon to 8 or 10 of water. As a summer spray the commercial form is being used very successfully, particularly upon the apple, pear and quince as a substitute for Bordeaux at the rate of one gallon to from 25 to 40 of water.

The third form is self-boiled, used entirely as a summer fungicide, principally for the brown rot of fruits. It is made as follows:

Stone lime 8 lbs.
Sulphur 8 lbs.
Water to make 50 gal.

Place the lime and sulphur together in a tight vessel and add enough water to slake the lime. Stir thoroughly and as soon as the lime is well slacked, dilute at once to 50 gallons, straining through a sieve with at least 20 mesh to the inch. This is the safest form to use on the stone fruits while in leaf.

WHALE OIL SOAP.—This solution is sometimes used as a remedy for scale and plant lice. One to two pounds of fish oil soap dissolved in one gallon of water (sprayed while warm) is the common strength used for scale. One pound of soap in 5 to 7 gallons of water is an effective remedy for plant lice.

BORDEAUX MIXTURE 1.

Copper sulphate (blue stone) 4 pounds.
Ground hydrated lime 6 pounds.
Water 50 gallons.

This formula should usually be used in all cases where Bordeaux is applied while plants are dormant. Place the required amount of copper sulphate in a gunny sack and suspend near the surface of the water. Dilute to 15 or 20 gallons. Place the required amount of lime in another vessel, and dilute to 15 or 20 gallons. Pour the two solutions together and spray. Stock solution of both lime and sulphate may be had by dissolving or mixing a certain number of pounds to a definite amount of water and then taking a portion of the solution or mixture each time, which will contain the proper amount of each material.

BORDEAUX Mixture 2.

Copper sulphate 2 pounds
Ground hydrated lime 4 pounds.
Water 50 gallons.

Prepared the same as 1. Preferable to 1 in all cases after the leaves are out.

THOROUGHNESS

Thoroughness is the key-note to successful spraying. Any other work of the orchard can be poorly done with less disastrous results. It is absolutely necessary, especially when spraying for diseases, that every particle of surface be covered with the material. Promptness is only second to thoroughness. As

will be seen, elsewhere in this pamphlet, the nature of the particular insect or disease sets well defined limits to the period in which spraying will be most effective.

SPRAYING OUTFIT

The kind of spraying outfit used will have much to do with thorough and timely work. Size and type of outfit will depend upon the kind of work to be done. Generally, any outfit smaller than a good barrel pump, with proper nozzles, extension rods, etc., will not be satisfactory and with five acres or more of good sized trees, a power outfit will be found economical. Pumps with a submerged cylinder and all working parts of brass or porcelain are preferable. The pump should be equipped with an agitator which will stir the liquid with each stroke of the handle. The nozzles should of course be of brass. Some form of the enlarged "vermorel" type, such as the "Mistry Jr.," "Friend," "Vapo," "Cyclone," "Whirlpool," etc., should be used. Never less than 25 feet of hose should be used and in case of large trees longer lengths will be desirable. One-half inch size made especially for the purpose will always be best. Extension rods will also be necessary. The brass or aluminum lined bamboo rods eight or ten feet long are always preferable. The modern gasoline power sprayer, is, on the whole, the most satisfactory form where considerable spraying is to be done. The high and uniform pressure at which these pumps force the liquid through the nozzle (100 to 200 pounds to the square inch) breaks up the spray into a very fine mist and makes possible a very rapid, yet uniform application without waste of material.

Before spraying can be intelligently done, the sprayer should have a general knowledge of the more important insects and diseases. He should know something about their life habits, as well as the time

and manner of their attack. It is the purpose of this pamphlet to give this information in the briefest form possible. There are, of necessity, many interesting points omitted for want of space, and only the most common enemies have been discussed.

INSECT ENEMIES OF THE APPLE, PEAR AND QUINCE

CODLING MOTH.—(Apple Worms.) This insect doubtless causes greater losses to growers of apples, pears and quinces than any other. It is usually two brooded. The larva live over winter in cocoons which they spin around themselves under the scaly bark or in any other convenient hiding place. In early spring they change, first into the pupa form and then into the adult moth, which begins to appear about blooming time and continues to come out for three or four weeks. The moths lay their eggs on or in the vicinity of the fruit, chiefly on the new leaves. In a few days the eggs hatch into the larvae or worm, the majority of which crawl to the eye or calyx end and enter the fruit there. They remain in the fruit from twenty to thirty days, when they leave it, crawl under some protecting covering and at once pupate, appearing as the second brood of moths from the 25th of June to the 20th of July, depending upon location and weather conditions. They finally leave the fruit and pass the winter as described.

Spray thoroughly with three to five pounds of arsenate of lead, or six to ten ounces of Paris green to 50 gallons of Bordeaux or lime-sulphur (Paris green cannot be safely used with lime-sulphur) just as the blossoms have fallen, and again in from seven to ten days. About eight or nine weeks after the petals fall a third application should be made for the second brood.

SAN JOSE SCALE—This is a sucking insect and perhaps the worst of the group. It attacks all fruit trees, being least troublesome upon the sour cherry. On badly infected trees it appears as a dark scurf made up of countless numbers of insects. While quite young the scale are yellowish in color and may be seen crawling about hunting a favorable location. Once it inserts its mouth parts in the bark it secretes its scale and remains in one position throughout life. On the fruit and young branches it causes a characteristic reddish coloring. The lime-sulphur wash is the most satisfactory remedy for this pest, although kerosene emulsion, whale oil soap and miscible oils are also used to some extent. Spraying should be done in the late winter or early spring just before growth begins. If trees are badly infected they should be sprayed in the fall immediately after the leaves fall and again in the spring.

SCURFY BARK LOUSE AND OYSTER SHELL BARK LOUSE.—The former is whitish and somewhat pear shaped, while the latter is oyster shell shaped and grayish or brownish in color. These insects sometimes cause some damage, especially on young trees, but are never so pernicious as the San Jose scale. Spraying with lime-sulphur will usually keep them in check, or watch for the appearance of young and spray with weak kerosene emulsion or whale oil soap.

CURCULIO.—This insect is becoming more troublesome each year upon the apple, pear and quince. It has been commonly considered as a stone fruit pest. For description and remedies see page 27.

GREEN APHIS.—(Plant Lice.) They usually pass the winter in the egg stage. In this stage they are partially destroyed by lime-sulphur or other strong contact poisons. If the lice begin to appear on the young foliage, a weak kerosene emulsion or soap

solution will be the most satisfactory remedies. Any material should be applied before the leaves curl badly, and under high pressure, in order to reach the insects. Small trees, two to three years set, may be effectively treated by dipping the affected branches into a bucket of the materials mentioned above.

WOOLLY APHIS.—This is a small brownish insect covered with a grayish white cottony covering. It may be found either on the roots or branches but does its greatest damage upon the roots, where it causes gnarled and warty conditions which interfere with their usefulness. Trees should be carefully examined before planting to see that they are free from this pest. On the branches it is easily controlled by spraying with kerosene emulsion or lime-sulphur. When beneath the soil it is more difficult to destroy. The dirt should be removed from the main roots and the surrounding soil, as well as roots, thoroughly soaked with kerosene emulsion, then sprinkled with tobacco dust and the soil returned.

CANKER WORM.—This insect lives over winter in the soil, and with the first warm spell of spring comes out and the wingless females crawl up the trees and deposit their eggs. The eggs hatch from the 15th of April to the 15th of May, depending on weather conditions, and the young larvae immediately begin to eat the leaves which are often entirely destroyed. Spraying with three to five pounds of arsenate of lead to 50 gallons of water will destroy this insect. Owing to the fact that the female is wingless and must crawl up the tree, a barrier of cotton or some sticky material is often placed around the tree. If well placed in good time, this proves an effective remedy and does away with the necessity of spraying.

BORERS.—Both round and flat headed borers are found in orchards of the apple, pear and quince. The eggs are laid in May or early June, usually near the

ground, but often higher up on the trunk or larger branches. The young larvae eat through the bark under which they feed for two or three years and then emerge again as adults. On account of their habits the most effective method of destruction is by annual inspection and removal of the grubs with a sharp pointed knife. The most effective protective measure is to paint the lower part of the stem with a fairly thick paint of pure white lead and linseed oil.

DISEASES OF THE APPLE, PEAR AND QUINCE

SCAB.—This is one of the most common and destructive diseases of this class of fruit. It passes the winter on the leaves, twigs, and diseased fruit, very early attacking the young foliage, bloom and new fruit. In the first stage it causes dark olive green spots on the leaf and fruit which finally turn brown or black, causing both to drop prematurely. If the fruit does remain on the tree it becomes cracked and distorted and its value is greatly lessened if not destroyed entirely. Spraying with Bordeaux 1 or lime-sulphur before the leaves come out, Bordeaux 2 or lime-sulphur just as the blossoms fall, and one or two more sprayings at intervals of ten days will prevent this disease.

FROG EYE SPOT OR LEAF BLOTCH.—This disease is nearly always associated with the black rot spot of the apple and is quite a serious pest in some parts of Ohio. There are a number of these leaf spots or blights, similar in appearance, all of which work their chief injury by causing premature falling of the leaves. The general spraying given the more prominent diseases will usually hold them in check.

BITTER ROT.—The bitter rot develops on half grown and matured fruit. Numerous small spots

appear which rapidly enlarge, finally showing a depressed and shrunken center. The disease passes through the winter on "mummy" fruits and in limb cankers. It is extremely important that the diseased limbs and mummied fruits be destroyed. The trees should be sprayed with Bordeaux or lime-sulphur once before the buds open and frequently thereafter until fruits are almost ripe. Bordeaux 2 should be used after the leaves come out.

BLACK ROT.—This is very similar to the Bitter Rot in the nature of its injury and development, and the treatment is similar. Its worst injury, probably occurs in the leaf spot forms.

BLOTCH.—This disease causes blotches with irregular fringed margins upon the skin of the fruit. At first these blotches seem purely superficial and unimportant; later they run together and extend deeper into the tissue, causing the fruit to crack, often down to the core, rendering it largely unfit for sale and valueless for storing. The twigs, spurs and shoots are also affected, causing canker spots with furrowed and roughened bark. Careful pruning to remove affected twigs, together with spraying, will usually control this disease. The first spraying with Bordeaux 2 should be made about three weeks after the blossoms fall, followed by three more sprayings at intervals of three or four weeks.

FIRE BLIGHT.—This is a bacterial disease which attacks the apple, pear and quince, but is most injurious upon the pear. The leaves and whole branches suddenly shrivel and die, giving the impression of fire injury. The germs gain access principally through wounds and through the flowers. The only satisfactory method of treatment is to cut out and burn every particle of blight as rapidly as it appears. A weekly inspection should be made

throughout the growing period. In each case the cut should be made well below any external evidence of disease, and the wound disinfected each time by sopping with a sponge saturated with a solution of corrosive sublimate (1 part to 1000). If the wound is large it should then be painted with a lead paint. Inspection and removal of diseased parts must be persistent if results are to be secured.

CROWN GALL. This is a bacterial disease affecting the roots of all plants of the rose family, but especially the apple and peach. It causes roughened warty enlargements, usually near the crown of the plant, but sometimes upon the small roots and also the body of the tree. It causes a faulty root system and finally kills the tree. It promptly develops on nursery stock and since it may easily be detected, all infected plants should be discarded at planting time. There is no known remedy after infection.

GENERAL OUTLINE FOR TREATING THE ENEMIES OF APPLES, PEARS AND QUINCE

No. 1. Spray during February or March with lime-sulphur if the scale is present. If not, either the lime-sulphur or Bordeaux 1 may be used at this time. If trees are badly infected with scale spray with lime-sulphur in the fall as soon as the leaves drop and again in the spring.

No. 2. Spray with Bordeaux 2 with three to five pounds of arsenate of lead to 50 gallons of water immediately after the petals fall.

No. 3. Repeat No. 2 within ten days or two weeks.

No. 4. Again repeat No. 2 between June 25th and July 10th.

No. 5. If troubled with bitter rot, two or three more sprayings with Bordeaux 2 only, at intervals

of ten days or two weeks will be necessary. Nos. 1, 2 and 3 are the most important sprayings, No. 4 sometimes being necessary when the second brood of the codling moth is especially bad.

No. 6. Avoid planting nursery stock with crown gall or woolly aphis upon it.

No. 7. Inspect the orchard in April or early May for borers, destroying the same with a sharp pointed knife.

No. 8. Continually watch for and cut out all fire blighted twigs and branches during the growing period.

No. 9. Gather and destroy all mummy fruit and cut out all cankered branches in the fall or winter.

INSECTS AFFECTING THE PLUM, CHERRY AND PEACH

CURCULIO.—This insect attacks plums, cherries and peaches about in the order named. It is sometimes found on other fruits also. The adult insect, a small grayish brown beetle, lays its egg in the young fruit and then stings it, making a characteristic crescent-shaped mark below the egg puncture. The egg soon hatches and the young larva eats its way into the fruit, causing it to drop or ripen prematurely. This is the common worm of the stone fruits. When full grown it comes out of the fruit, goes into the ground where it remains over winter, the adults again appearing about blooming time. Spray with 3 to 5 pounds arsenate of lead in Bordeaux just as the buds are swelling, but before they have opened; again just as the blossoms are falling and a third time four to six days later. A cultivation late in the fall will help in holding them in check, by breaking up and destroying their winter hiding places.

PEACH BORER.—This is a very common pest of the peach orchard, sometimes found attacking the cherry and plum also. The adult moth deposits its eggs upon the tree in May usually near the surface of the ground. The resulting larvae eats its way beneath the bark where it lives for two or three years. Removal of the grub with a sharp pointed knife in April and September is the only safe remedy. Their presence is always indicated by a gummy exudate from their wound, mixed with their sawdust-like castings.

SCALE INSECTS.—The San Jose Scale is the only one seriously attacking the stone fruit. The treatment is the same as that already described for this pest on the apple, etc.

APHIS. Several species of aphids attack the stone fruits. The black aphid on cherries is often a serious pest. Remedial measures are the same as for the apple aphid.

BARK BEETLE.—This insect lives over winter, both in the adult and larval state, in the winding tunnels it eats through the soft bark of the trunk and branches. It passes to and from the tree through small shot-like holes which are easily recognized. Birds are the most effective winter agent of destruction. Badly infested trees and all prunings should be burned before spring opens. Trees not severely injured should be liberally fertilized, and then white-washed or painted with a wash consisting of one pint crude carbolic acid, one gallon of whale oil soap, dissolved in eight gallons of soft water.

DISEASES AFFECTING THE PEACH, PLUM AND CHERRY

BLACK KNOT.—This common disease, especially serious on plum and sour cherry, appears as a black swelling, first upon the smaller branches and later

spreading to the larger limbs. Persistent removal of the affected branches and spraying with Bordeaux to prevent new infection will usually control it. When the attack has become general over the entire tree the tree should be destroyed.

BROWN ROT.—Probably no other disease is so destructive to the stone fruits as is the brown rot, which attacks the fruit as it approaches maturity, turning it brown, soft and useless. The flowers and twigs are also attacked and injured. Fruits touching each other are most subject to the trouble, although none is free from attack. Fruit may be attacked after it is picked, and reach market in poor condition even though it was sound when shipped. Decay is so rapid that infection today may mean almost total loss two days hence. The diseased fruit may fall to the ground, or remain upon the trees as the "mummy" fruit so familiar to all. These fruits serve as the wintering place for the disease and should be destroyed before the coming of spring. Three sprayings with self-boiled lime-sulphur will materially control it. The first spraying should be given about three weeks after the blossoms fall, the last about a month before the fruit ripens and the second about half way between the other two. Sometimes a fourth treatment for susceptible varieties should be given about three weeks before ripening. Warm, moist weather is especially favorable for the disease.

PEACH SCAB. This disease is so common and widespread that many people believe it to be a part of the fruit. It consists of small sooty black specks which may run together and sometimes cover one-half or more of the peach. The part attacked is dwarfed, cracks and remains green and bitter even after the normal part has ripened. Self-boiled lime-sulphur, as recommended for the brown rot, will also control this disease.

LEAF CURL.—This disease is due to a fungus which grows in the leaves, causing the peculiar curled and crumpled formation giving rise to the name. The function of the leaf is largely destroyed and often falls off early in the season. It works its injury first by injuring the immediate crop, and second by lessening the vitality of the tree for future crops. Spray with Bordeaux or lime-sulphur just before the buds open and just after the calyx drops.

PEACH YELLOWS.—The peach yellows has been known for many years in the United States and is now a common disease in most peach growing regions. The true symptoms of yellows are, first, prematurely ripe, red-spotted fruits with the flesh marbled from the skin to the seed; second, the premature growth of winter buds and the development of bunches of slender, wiry, reddish-yellow twigs upon the larger branches. Growth usually continues until late in the season. So far no remedy has been discovered for this disease except to avoid planting infected nursery stock and to dig up and remove all orchard trees as soon as they show any signs of infection. While no tree is immune from this disease under any condition, well pruned, well sprayed and well fed trees are usually the last to succumb.

GENERAL OUTLINE FOR TREATING THE ENEMIES OF PEACH, PLUM AND CHERRY

No. 1. Spray with lime-sulphur just before the buds open if San Jose Scale is present.

No. 2. Spray with Bordeaux 2 containing 3 pounds of arsenate of lead to 50 gallons of water just after the calyx drops.

No. 3. Spray with the self-boiled lime-sulphur about three weeks after the petals fall and repeat two

or three times at intervals of ten days or two weeks, depending on weather conditions.

No. 4. Inspect the orchard in April and September and dig out all borers with a sharp pointed knife.

No. 5.—Pull out and burn all trees showing any signs of yellows, little peach or general decline.

No. 6. Gather and destroy all "mummy" fruits in the fall of the year.

BULLETINS OF

The Agricultural Experiment Station, Wooster, O.

The Agricultural Experiment Station, Lafayette, Ind.

The Agricultural College, Columbus, O.

The State Board of Agriculture, Columbus, O.

Any of the above bulletins will be sent free to any resident of the state upon request.

AN EFFECTIVE PAINT TO PREVENT INJURY TO YOUNG TREES BY RABBITS

4 lbs. sulphur.

4 lbs. yellow ochre.

4 lbs. flour.

4 lbs. linseed oil.

4 oz. turpentine.

4 oz. asafetida (Dissolve in 1 pt. alcohol).

½ doz. eggs.

Mix to consistency of thick mush with buttermilk, then thin to a paint with sweet milk. Apply with a brush.

93.21	AUTHOR.	Paddock	
P130	TITLE.	Orcharding.	1911.

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Title**