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DEPARTMENT OF HORTICULTURE

SPRAYING FRUIT PLANTS¹

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Spraying is the most scientific and technical operation connected with the production of fruit crops. Spraying is a preventive measure, and in order to secure good results the application must be made at the right time, of the correct materials, and with thoroughness. The spray schedules and other information given in this circular apply to Kansas conditions in general but must be modified to meet unusual or local conditions.

The grower must know which pests are liable to give him trouble and something of their nature or habits before he can do intelligent spraying. There are two types of organisms attacking fruit plants and in general each must receive special spray treatment for control. These are insects and fungous diseases.

INJURIOUS ORCHARD INSECTS

San Jose scale is one of the most important of the fruit insects. Much damage has been done in recent years to both home and commercial plantings by it. This insect is small and inconspicuous. The grower who does not know how to identify it should consult some one who does. Thorough spraying with the correct materials will keep it under control.

Aphids or plant lice are troublesome during some seasons on all kinds of fruit trees. This insect has sucking mouth parts and is controlled by using some material which kills by coming into contact with the insect's body.

The codling moth is the most serious insect pest of the apple which the grower must combat. The larva form of this insect causes wormy apples; the adult or winged form is a shy inconspicuous moth. There are from two to four broods or generations of this insect each season and since these generations usually overlap, it is a difficult pest to control. In the most severe infestations spraying alone has not given satisfactory control. In most parts of Kansas, however, thorough and timely spraying with arsenate of lead in conjunction with sanitary orchard practices will keep the pest under control.

1. Contribution No. 67 from the Department of Horticulture.

Apple and plum curculios have been causing noticeable damage to the apple crop in northeastern Kansas in recent years. The injury to the fruit is caused by the plum curculio puncturing the fruit when the eggs are deposited just under the skin of the fruit. This puncture is crescent shaped. The plum curculio also causes wormy drupe fruits, plums, peaches, and cherries being especially susceptible. The apple curculio makes circular-*or* irregular-shaped feeding punctures on the fruit. If the recommended spray schedule is followed and general orchard sanitation practiced, these pests will usually be kept under control.

FUNGOUS DISEASES OF FRUIT

Apple blotch is a serious disease of the fruit on Huntsman, Maiden Blush, Ben Davis, Missouri, Arkansas Black, Cooper, and many other important Kansas varieties. The disease also attacks water sprouts, twigs, and small branches and leaves. Blotch spots on the fruit are irregular in shape, a feature which distinguishes them from apple scab lesions. Severely infected fruits may crack open.

Blotch can be controlled by proper spraying. Experiments at the Kansas Agricultural Experiment Station indicate that Bordeaux mixture is the best spray to use. From two to four applications per season are usually required on the blotch-susceptible varieties. The first of these is made 14 days after petal fall, the other applications following at two-week intervals.

Apple scab is a serious disease on fruit and foliage of Winesap, Stayman Winesap, Delicious, and Ben Davis. The twigs are also infected occasionally. The scab lesions do not grow deeply into the fruit, although in exceptional cases the spots grow together and the fruit may crack badly. On the leaves the spots are usually circular in outline varying from olive brown when first noticeable to nearly brown as they become older. This disease may be serious in young nonbearing orchards, due to the defoliation of the trees. Spraying with lime-sulfur early in the season as indicated in the spray schedule will usually keep the disease under control.

Cedar rust must rotate its attacks from the red cedar to the apple and to the cedar again in order to complete its life cycle. The disease is of primary importance on the foliage of Wealthy and Jonathan trees. Spraying is of little or no value in controlling this disease. If susceptible varieties are grown, all cedar trees within a mile of the orchard should be destroyed.

Fire blight is a bacterial disease of apples and pears. The growing tips and blossoms are killed by the disease, Aphids and other insects do damage in disseminating fire blight spores and spraying is of value in reducing these means of dissemination. Special information concerning this disease can be secured on request.

Blister canker is a fungous disease which has done much damage to the Ben Davis, Gano, Missouri, and Wine-sap orchards in Kansas. The disease enters through some wound or break in the bark and grows down through the wood under the bark. Spraying is of no value in controlling this disease.

Peach leaf curl is a serious disease of peach foliage in some seasons. Diseased leaves are thickened and distorted. A thorough dormant spray of lime-sulfur will give complete control of this disease.

Brown rot is a fungous disease which attacks peaches, plums, and cherries. Brown rot is most damaging during hot rainy weather, often just before harvest, although the disease causes widespread damage early in the season by attacking young fruits. The disease overwinters on mummies or dried-up fruits which lie on the ground or hang on the trees. The destruction of these mummies aids in controlling the disease. Thorough spraying with lime-sulfur or Bordeaux, in conjunction with orchard sanitation, usually keeps this disease under check.

Cherry leaf spot is a disease of the foliage of cherry trees which has caused widespread damage in Kansas by defoliating the trees during the growing season. Spraying with either lime-sulfur concentrate diluted 1 to 35 or Bordeaux, 3-6-50, will give good control of the disease. In experiments in the college orchards, lime-sulfur was found to be superior to Bordeaux in that the fruits from trees sprayed with lime-sulfur were larger than those from trees sprayed with Bordeaux mixture.

SPRAY MATERIALS

Spray materials are divided into two classes — insecticides and fungicides. Insecticides are those sprays which are applied for the control of insects such as the San Jose scale and the codling moth. Fungicides are those sprays used for controlling the fungous diseases such as apple scab and apple blotch.

There are two classes of insecticides — stomach poisons and contact sprays. Lead arsenate is the most important stomach poison and nicotine sulfate and the oil emulsions are the important contact sprays.

INSECTICIDES

Lead arsenate is the most important stomach poison used in spraying. It is applied for insects like the codling moth which bite out and swallow plant parts. The product is commonly sold as a dry white powder. The usual dilution is from 1 to 1½ pounds of the poison to 50 gallons of water or spray. For small amounts a teaspoonful may be mixed with a gallon of water. Lead arsenate does not dissolve to any appreciable extent. This makes it necessary to keep the mixture stirred up to prevent the lead arsenate from settling out. Lead arsenate may be used in combination with nicotine sulfate, Bordeaux mixture, or lime-sulfur sprays.

Nicotine sulfate is one of the most important sprays for insects of the aphid or plant-lice type that have sucking mouth parts. Nicotine sulfate may be purchased from drug stores or any of the spray supply houses. It is marketed as a heavy dark brown liquid. It may be applied to plants at strengths sufficient to kill plant lice without danger of injuring the foliage or fruit. The usual dilutions range from 1 to 800 parts of water, to 1 to 1,600 parts of water. Nicotine volatilizes more quickly if the solution has been rendered alkaline. Nicotine kills by paralyzing the insects after the nicotine vapors have entered the bodies through the breathing pores. To be effective, therefore, the solution should be alkaline. This is easily attained by the use of two or three pounds of soap in 50 gallons of spray when nicotine is used alone. Soap should not be added when the nicotine is used with lime-sulfur or Bordeaux mixture.

Oil emulsions are being used by some growers to combat San Jose scale. More experimental evidence is required before this type of spray can be generally recommended in Kansas.

Lime-sulfur concentrate or commercial lime-sulfur is a heavy red liquid and is one of the most important of the spray compounds. This material may be prepared at home if a sufficient quantity be used to warrant the trouble. It is recommended that the average home orchardist or small commercial orchardist purchase this product, unless several growers can profitably cooperate in its manufacture. Those interested may secure special information concerning the home manufacture of lime-sulfur on request.

When liquid lime-sulfur is diluted at the rate of 1 part of lime-sulfur to 6 or 8 parts of water the spray is used as a dormant spray for the control of San Jose scale.

FUNGICIDES

Lime-sulfur concentrate diluted at the rate of 1 part to 35 or 40 parts of water is one of the standard fungicides and is used for the control of apple scab, cherry leaf spot, and other diseases. If the lime-sulfur solution is kept sealed from the air in some tightly stoppered container in a place where this liquid will not freeze, it may be kept from one season until the next.

Dry lime-sulfur is a substitute for the liquid form and, due to the greater convenience in handling this product, many home orchardists are using it. The instructions given on the container as sent out by the manufacturers should be strictly followed.

Bordeaux mixture is one of the best of the fungicides. This spray is of great value in the control of apple blotch. The spray may be made at home as follows: The general formula of 3-6-50 should be used. This means 3 pounds of copper sulfate (blue vitriol) and 6 pounds of fresh hydrated lime to each 50 gallons of spray. The copper sulfate should be dissolved in about 3 or 4 gallons of water. The spray tank should be filled to about the 40-gallon mark, the 3 or 4 gallons of copper sulfate solution added, and the dilute solution stirred. Into this should be poured immediately a thin paste made of 6 pounds of fresh high-grade hydrated lime in 5 or 6 gallons of water. The resulting mixture should be stirred or agitated vigorously and used the same day it is made.

Smaller quantities may be prepared by reducing the formula to the desired amount.

Metal containers should not come into contact with the concentrated solution of copper sulfate. Only fresh, high-grade hydrated lime should be used.

Nicotine sulfate and lead arsenate may be used in combination with Bordeaux if the pests to be combated make such a combination desirable.

Bordeaux mixture is sold on the market in the paste or powder forms. These are not so satisfactory as the freshly prepared home-made Bordeaux.

Dry-mix lime and sulfur is recommended as a fungicide for peaches and tender plums. The general formula, as developed by the New Jersey Agricultural Experiment Station, for making 50 gallons of spray is as follows:

Flowers of sulfur	8 pounds
Fresh hydrated lime	4 pounds
Calcium caseinate or Kayso	½ pound

These amounts may be proportionately increased or decreased, depending upon the quantity desired.

The ingredients are mixed together dry and sifted to remove lumps. A thin paste with water is made and slowly added to the spray tank which should be nearly full of water. The mixture is thoroughly stirred or agitated, the water brought up to the correct level, and used immediately. Lead arsenate may be added if chewing insects are present or nicotine sulfate may be added if plant lice are troublesome.

SPRAY SCHEDULES

SPRAY SCHEDULE FOR APPLES

No. 1. Delayed Dormant Spray

For San Jose and other scales and plant lice.

Commercial liquid lime-sulfur is used at the rate of 1 gallon to 7 or 8 of water. At this strength 6 gallons of lime-sulfur and 44 gallons of water would be required for each 50 gallons of spray.

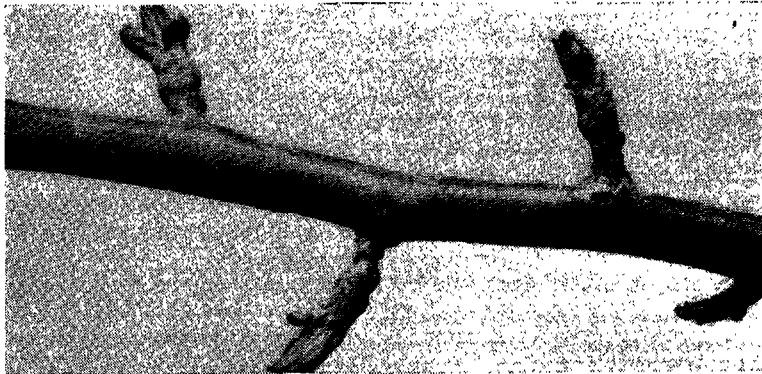


FIG. 1.—Apple buds at the stage of development at which the delayed dormant spray should be applied.

This spray is usually applied when the buds begin to show green tips. (Fig. 1.) In large orchards it is often necessary to start its application a trifle earlier in order to insure its completion before the cluster-bud stage is reached.

This spray is primarily designed for the control of San Jose scale but often assists in checking aphid damage also.

No. 2. Prepink Spray

For apple scab, curculio, canker, worm, and tent caterpillar.

This spray consists of the following materials:

- Commercial liquid lime-sulfur 1½ gallons
- Powdered arsenate of lead 1 or 1½ pounds
- Water 50 gallons

The prepink spray is applied when the cluster buds are separating enough to expose the blossom buds but before these show pink. That is just between the delayed dormant and the pink or cluster-bud stage. This spray is seldom used in Kansas orchards, although it may prove valuable in the control of scab or susceptible varieties during years especially favorable for the development of this disease. It may also assist materially in the control of apple curculio in districts where that insect is particularly troublesome.



FIG. 2.—Upper Left: Apple fruit spur showing the right time to start the application of the pink or cluster-bud spray. Lower Left: The same fruit spur later showing the stage at which the pink or cluster-bud spray should be finished. Right: Fruit spurs showing the best time to start the application of the calyx or petal-fall spray. The petals have just fallen.

No. 3. Pink or Cluster-Bud Spray

For apple scab, curculio, canker worm, and tent caterpillar.

This spray consists of:

- Commercial liquid lime-sulfur 1½ gallons
- Powdered arsenate of lead 1 or 1½ pounds
- Water 50 gallons

This spray is applied when the buds have separated in the cluster and show pink, but before the blossoms open. (Fig. 2, upper and lower left.)

When arsenate of lead is to be used with lime-sulfur sprays, the water and lime-sulfur should be placed in the tank first and the lead which has been stirred up in a small quantity of water should be added to the spray tank just before the spray is applied, and with the agitator in motion.

If aphid damage is threatened, 1/2 pint of nicotine sulfate may also be used for each 50 gallons of spray material. However, this material is probably more effective when added to the delayed dormant or prepink spray.



FIG. 3.—Left: Apple fruit spur showing calyx cups nearly closed. The calyx-cup spray should be applied at once. Right: Closed calyx cups. At this stage of growth it is too late to apply the calyx-cup spray.

No. 4. Calyx-Cup or Petal-Fall Spray

For apple scab, codling moth, canker worm, and curculio.

This spray consists of:

- Commercial liquid lime-sulfur 1 1/2 gallons
- Powdered arsenate of lead 1 or 1 1/2 pounds
- Water 50 gallons

The grower may start this calyx-cup spray when from one-half to two-thirds of the petals have fallen from the blossoms and it should be finished before the calyx cups close. (Figs. 2, right, and 3.)

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This spray is particularly important in combating the codling moth or apple worm, as a considerable number of these insects, especially those of the first brood, gain entrance to the apple through the calyx. Poison lodged in the calyx cup by this spray may remain effective throughout the season.

No. 5. Second Codling Moth and First Blotch Spray

For codling moth, canker worm, apple scab, and apple blotch.

Bordeaux mixture, 3-6-50, with 1 or 1½ pounds of powdered arsenate of lead for each 60 gallons of spray, is the application recommended for general use. It should be applied approximately 14 days after petal fall.

Bordeaux mixture rather than lime-sulfur is recommended for this spray because it has proved to be the most effective fungicide for the control of apple blotch, and also because it is less apt to burn or russet fruit and foliage, on hot sunshiny days.

Bordeaux may cause injury during damp, foggy, or rainy periods, but if the weather is at all suitable most growers will prefer to risk Bordeaux russetting rather than to have the fruit of blotch-susceptible varieties ruined by this disease.

Lime-sulfur at the same strength recommended for the petal-fall application has been successfully substituted for Bordeaux mixture by some growers for use on varieties which are not attacked by blotch, but which may be injured by late scab infection. This choice of materials will depend largely on the previous experience of the orchardist. It may be well to reduce the strength of lime-sulfur somewhat during unseasonably warm weather.

An arsenate of lead spray alone, at the rate of 1 pound of the powdered form to 50 gallons of water, may be sufficient at this time on varieties not attacked by either scab or blotch, such as Grimes or Jonathan.

No. 6. Third Codling Moth and Second Blotch Spray

For codling moth, apple blotch, and curculio.

Bordeaux mixture, 3-6-50, together with 1 or 1½ pounds of arsenate of lead, as recommended in the previous spray, should be used on varieties susceptible to blotch.

This spray should be applied approximately four to five weeks after the petal-fall spray (No. 4).

In orchards where varieties susceptible to blotch are inter-mixed with those that are somewhat resistant, it is often best to use the Bordeaux for both this and the preceding blotch spray. This will be determined largely by the previous experience of the grower.

Lime-sulfur is used by some growers in the northern part of the state, rather than Bordeaux at this stage on blotch-resistant varieties, but it is well when using it to cut down the strength to 1 to 50 on bright hot days to prevent burning of fruit and foliage, or to omit it entirely using only an arsenate of lead spray on those varieties, unless considerable late scab infection is probable.

On varieties not susceptible to blotch, an arsenate of lead spray alone is often sufficient for this application.

No. 7. Second Brood Codling Moth Spray
For codling moth, and apple blotch.

This spray consists of powdered arsenate of lead, 1 or 1½ pounds to 50 gallons of water, or if late blotch infections are to be combated, the arsenate of lead should be combined with 3-6-50 Bordeaux. (As many as four Bordeaux sprays at intervals of two weeks starting with the "14-day spray," may be necessary to control blotch infections on badly diseased trees and very susceptible varieties.)

The first spray for the second brood of codling moth is usually applied eight or nine weeks after petal fall, but should be determined accurately by use of emergency cages and by orchard observations.

When arsenate of lead is used alone, some experimenters recommend the use of a spreader with it to assure a uniform coating of poison on the fruit; others have found the practice of little value. Experimental data on this point are conflicting, but it may be said that on the average as good results have been obtained without the use of spreaders as with them. If a spreader is to be used the directions accompanying it should be closely followed.

No. 8. Third Brood Codling Moth Spray
For codling, moth, and sooty blotch.

This spray will consist of powdered arsenate of lead, 1 or 1½ pounds to 50 gallons of water. Or, if sooty blotch or other fungous diseases are in evidence, it may be well to use a fungicide in this application; this will be influenced largely by the weather.

The spray for the third brood of codling moth is applied when the need is shown by the codling moth cage, usually during August.

SPRAYING PEARS

While the preceding schedule has been prepared for apples, it should also, with some modification, be effective for pears. Ordinary lime-sulfur sprays are liable to russet the skin of some varieties of pears and may cause severe burning in hot weather. Under such circumstances use Bordeaux, 3-6-50, or dry-mix lime-sulfur if a fungicide is

necessary. As a rule a fewer number of sprays is required for pears than for apples. The best plan is to determine the insects and diseases to be combated and to spray accordingly.

SPRAY SCHEDULE FOR AMERICAN PLUMS

Home orchardists may find it convenient to substitute dry lime-sulfur for the liquid form specified in this schedule, and manufactured Bordeaux for the home made. If either of these substitutions is made the directions supplied by the manufacturer should be followed.

About 4 pounds of dry lime-sulfur to 50 gallons of water is considered summer strength.

Six to eight pounds of manufactured dry Bordeaux to 50 gallons of water are usually considered equal to the 3-6-50 home-made formula.

No. 1. Dormant Spray

For San Jose scale.

Lime-sulfur, as recommended for apples, should be used if scale is serious.

This spray should be applied when trees are dormant, preferably in early spring.

No. 2. First Summer Spray

For curculio, and brown rot.

This spray consists of commercial liquid lime-sulfur, 1½ gallons to 50 gallons of water, plus 1 pound of powdered arsenate of lead to each 50 gallons of spray, or Bordeaux, 3-6-50, plus 1 pound of powdered arsenate of lead to each 50 gallons of spray.

This application should be made just before the blossom buds open.

No. 3. Second Summer Spray

For curculio and brown rot.

The use of either lime-sulfur or Bordeaux, 3-6-50, given as for spray No. 2, is recommended.

This spray should be applied immediately after the petals have fallen.

No. 4. Third Summer Spray

For curculio, brown rot, and scab.

Either the lime-sulfur or Bordeaux spray recommended under Nos. 2 and 3 may be used at this time.

This spray should be applied two weeks after petal fall.

No. 5. Fourth Summer Spray

For brown rot.

To be applied two weeks after No. 4 if brown rot has been troublesome in previous years. Either the lime-sulfur spray or the Bordeaux recommended under No. 2, may

be used. The Bordeaux is probably to be preferred in dry hot weather.

Dry-mix lime-sulfur, as recommended for peaches, may be used in this application.

It is usually not necessary to use arsenate of lead in any of the plum sprays at this time as the curculio should be under control.

No. 6. Fifth Summer Spray

For brown rot.

Later applications than No. 5 may be used in some instances if necessary, but the final spray should be applied two or three weeks before the fruit ripens.

SPRAY SCHEDULE FOR PEACHES, APRICOTS AND JAPANESE PLUMS

No. 1. Dormant Spray

For San Jose scale, leaf curl, and brown rot.

Commercial liquid lime-sulfur as for apples, dormant strength, 1 to 7 or 8, should be applied while the trees are dormant, preferably in early spring, shortly before growth starts.

No. 2. First Summer Spray

For curculio, scab, and brown rot.

Dry-mix lime-sulfur should be used. One pound of powdered arsenate of lead should be added to each 50 gallons of spray.

This spray should be applied after blooming when most of the shucks have fallen.

No. 3 Second Summer Spray

For curculio, scab, brown rot, and leaf spot.

The same spray mixture as in No. 2 is recommended. It should be applied two weeks after spray No. 2.

Due to rapid development of fruit and foliage it is advisable to follow in one week, if curculio persists, with an arsenate of lead spray.

No. 4. Later Sprays

For scab and brown rot.

Dry-mix lime-sulfur is recommended, to which arsenate of lead should be added if insects threaten.

This spray should be applied as necessary to control brown rot, usually four weeks before ripening begins.

SPRAY SCHEDULE FOR SOUR CHERRIES

Home orchardists may find it convenient to substitute dry lime-sulfur for the liquid form specified in this schedule, and manufactured Bordeaux, for the home-made. If either of these substitutions is made the directions supplied by the manufacturer should be followed.

In general about 4 pounds of dry lime-sulfur to 50 gallons of water is considered summer strength, while 6

to 8 pounds of manufactured dry Bordeaux to 50 gallons of water is usually considered equal to the 3-6-60 home-made formula.

No. 1 First Summer Spray

For curculio, and brown rot.

Commercial liquid lime-sulfur, 1¼ gallons to 60 gallons of water, plus 1 pound of powdered arsenate of lead to each 50 gallons of spray should be used; or, Bordeaux, 3-6-50, plus 1 pound of powdered arsenate of lead to each 50 gallons of spray, may be substituted.

This spray should be applied just before blossom buds open.

No. 2 Second Summer Spray

For curculio, brown rot and leaf spot.

Lime-sulfur as given for spray No. 1 is preferred, although Bordeaux may be used.

This spray should be applied when the petals have fallen.

No. 3. Third Summer Spray

For curculio, brown rot, and leaf spot.

Either the lime-sulfur or the Bordeaux spray recommended under Nos. 1 and 2 may be used at this time. The lime-sulfur spray is probably the better.

This spray should be applied two weeks after petal fall.

No. 4. After Fruit is Picked

For leaf spot.

Bordeaux, 3-6-50, should be applied after fruit is harvested, in case trees are seriously infected by leaf spot.

SPRAYING GRAPES

A spray schedule for grapes must be flexible. During some seasons it will be necessary to apply several sprays to insure a clean crop and healthy foliage while during other seasons, though rarely, no spray applications are needed.

Black rot, powdery mildew, and downy mildew are the important fungous diseases of the grape. Bordeaux mixture, 3-6-50, is used for controlling these diseases.

The grape leaf folder, the grape root worm, and the grape berry moth are important grape insects which are controlled by the use of arsenate of lead.

The above pests can usually be controlled by applying a combination spray of Bordeaux, 3-6-50, and 2 pounds of powdered lead arsenate to 50 gallons of spray, at the following times:

1. As the leaf buds are opening.
2. Just before the flower buds open.
3. Just after the blossoms fall.
4. Ten days after spray No. 3.
5. Two weeks after spray No. 4.

Anthracnose is an important grape disease in many grape-growing regions east of the Rocky mountains. Dormant strength lime-sulfur, 1 to 8, is important in controlling anthracnose. The summer Bordeaux sprays are also of value against this disease.

The grape leaf hopper is controlled by applying nicotine sulfate, ½ pint to 50 gallons of water, when the insect is in the nymph stage. The nymphs live on the under side of the grape leaves and are unable to fly although they run in all directions when disturbed. In spraying for the control of this insect it is important to use high pressure with a coarse driving spray and to have the nozzles so arranged that the spray is directed upward under the leaves. In this region the nymphs appear the last of June or early in July.

SPRAYING STRAWBERRIES

Spraying for Disease Control

The foliage of the strawberry is subject to the attacks of only one important fungous disease, the strawberry leaf spot. The leaf-spot lesions are purplish spots the centers of which are nearly white. The disease is found on the leaves of most varieties of strawberries. Aroma and Dunlap strawberries are damaged only lightly by the disease, while Warfield and Gandy are among the most susceptible varieties. During relatively dry seasons, the disease is more active than in moist seasons.

During moist seasons it does not pay to apply a spray to control the leaf spot. However, if conditions justify spraying, Bordeaux mixture applied just before the blossoms open and at intervals after the crop is harvested, will check the attack of the disease.

Spraying for Insect Control

Perhaps the most important insect which attacks the foliage of the strawberry and which may be controlled by spraying is the strawberry leaf-folder.

This insect appears as a small slender green caterpillar feeding on the inside of strawberry leaves which it has folded together and sewed with silk threads to form protection for itself.

An application of lead arsenate sprayed on the leaves before many of the leaves are folded will keep this insect in check. There are three broods of the insect each season but the later broods which appear after the crop of berries has been harvested do the most damage in Kansas.

The use of a short rotation is one of the best ways to

keep fungous diseases and insect pests of the strawberry under control.

SPRAYING BRAMBLES

Two important diseases of brambles, crown gall and orange rust, cannot be controlled by spraying. Plants infected with these diseases should not be accepted from the nursery. There is considerable variation among varieties in orange rust susceptibility.

Anthraxnose is an important raspberry disease which is difficult to control. Lime-sulfur applied as follows may prove beneficial:

1. In early spring before growth starts, apply concentrated lime-sulfur diluted at the rate of $2\frac{1}{2}$ gallons in 50 gallons of spray.

2. When new shoots are 6 to 8 inches high, use concentrated liquid lime-sulfur diluted at the rate of $1\frac{1}{2}$ gallons in 50 gallons of spray.

3. Just before the blooming period, use concentrated liquid lime-sulfur diluted at the rate of $1\frac{1}{4}$ gallons in 50 gallons of spray.

In addition to the application of sprays, old fruiting canes should be removed as soon as the crop is picked. The practice of rotation is also an important phase of disease control with these fruits.

More detailed information regarding San Jose scale, fruit tree borers, grape insects, cherry leaf spot, the home manufacture of lime-sulfur concentrate, etc., may be obtained upon request from the Agricultural Experiment Station, K. S. A. C., Manhattan, Kan.