

# Spraying Suggestions for Commercial Apple Orchards, 1948

By Departments of Horticulture and Entomology

A spray program must consider problems of plant injury, compatibility, residues and comparative efficiency. Spraying facilities and pest problems vary in different orchards, and modifications may have to be made to meet seasonal conditions or unexpected problems.

An attempt is here made to give suggestions and information regarding materials to permit growers to develop programs to fit their own situations. Suggestions for the use of some of the newer materials are given, based upon present information.

## Dormant Sprays

The pests against which dormant sprays are most likely to be needed are San Jose Scale, European red mite (in the egg stage) and, to a lesser extent, rosy aphid, also in the egg stage. The sprays usually are more effective and safer just before growth begins, or in some cases, as the buds swell.

There has been a general build up of San Jose scale in recent years. While there is some indication that use of DDT for the control of codling moth is favorable to San Jose scale, scale populations also have increased where no DDT has been used. With the present scale situation, together with the fact that DDT definitely favors the build up of red mites, the application of a dormant oil spray would seem advisable for many, if not most, orchards in the state. The rosy aphid is seldom serious enough to justify a special spray but where a dormant oil is applied for scale control the inclusion of an aphid egg toxicant might be worthwhile. The grain or migratory aphid, the eggs and nymphs of which are often found in great numbers on apple trees, does little if any damage and migrates from the apple soon after the blooming period.

1. For the control of San Jose scale use a dormant petroleum spray oil diluted to give 3 gallons of actual oil in 100 gallons. A 3 per cent oil spray is effective in reducing the hatch of red mite eggs. While a 2 per cent oil spray will control light infestations of San Jose scale, at least 3 per cent of oil is needed against red mite eggs. A 4 per cent dormant oil may be required where the number of red mite eggs is extremely high.

2. Several combination sprays are effective against aphid eggs as well as San Jose scale and red mite eggs. They may be divided into three groups as follows:

- (a) 3 per cent petroleum oil with a minimum of 6.4 ounces of actual dinitro compound (1 pound of 40 per cent wettable

dinitro powder or 1 quart of Elgetol or Krenite to 100 gallons). Where aphid infestation has been heavy 1 1/2 pounds of the dinitro powder or 1 1/2 quarts of Elgetol or Krenite may be used.

- (b) Tar oil-petroleum oil combinations which will give about 2 1/2 gallons of actual tar oil and 3 gallons of petroleum oil in 100 gallons. The tar oil alone does not control San Jose Scale.
- (c) Special aphid oils with enough petroleum oil to give 3 gallons of petroleum oil in 100 gallons.

3. Where the European red mite has been serious and eggs are abundant a 4 per cent petroleum oil spray alone is suggested in order to appreciably reduce the initial infestation in the spring.

All the sprays mentioned here except petroleum oil alone must be applied while the trees are dormant. The dinitro and tar oil sprays as suggested may cause considerable injury if applied after growth begins. Some cases of injury have been reported where "dinitro" with more than 1 gallon of oil to 100 gallons of spray has been used even when the buds are fully dormant. It is safer to apply the dinitro compounds ahead of an oil spray, - delaying the application of oil until after a rain to wash off most of the dinitro.

Petroleum oil sprays are more effective against both San Jose Scale and red mite eggs if delayed until after the buds swell. Such sprays should be completed before the buds are open enough for the oil to run inside. Oil inside the buds may cause injury; or injury may result from applications of sulfur a little later. A 4 per cent oil spray is safer when the buds are fully dormant.

Dinitro powders should be allowed to soak in a small amount of water for a few minutes and then made into a paste before being put in the spray tank. There is risk of dry powders lumping when dumped into the tank. Liquid or paste preparations such as Elgetol and Krenite require considerable stirring to give an even mixture of the dinitro chemical, which settles and more or less cakes on the bottom of the container on long standing.

When a "dinitro" is to be used with oil, first add the oil and then pour in the dinitro slurry after the tank is at least half full.

Where oil is used against red mite eggs, be sure to thoroughly spray the entire tree including the under sides of the twigs on the lower branches where many of the eggs are usually found.

Do not spray immediately ahead of a forecast for cold weather or when the spray is likely to freeze before drying.

## Hexaethyl Tetraphosphate for Control of Rosy Aphids

Hexaethyl tetraphosphate has been reported to be effective against aphids after hatching. Where rosy aphids have been a problem, hexaethyl tetraphosphate may be used at manufacturer's recommendations as a special spray between the time that the ends of the buds open until

the time of petal fall, preferably in the earlier stages of bud development. It may be used in combination during this period with wettable sulfurs or Fermate.

Do not use it in combination with lime sulfur or any material containing lime.

## A Ground Spray for Scab Control

A well applied ground spray by killing much of the over-wintering scab on the old fallen leaves greatly reduces the amount of primary infection -- an important factor in the control of apple scab. Where scab control has been unsatisfactory or there is a heavy carry-over of scab, a ground spray is a valuable supplement to the regular scab sprays. In fact, with a heavy carry-over followed by a favorable scab season a ground spray may mean the difference between satisfactory and unsatisfactory control, especially on scab susceptible varieties. With scab well in hand, the application of a ground spray is probably not justified except where a mild fungicide program is to be followed and it is felt that the risk of such a program is too great without some supplementary control. Unless a ground spray is followed by thorough spraying during the spring infection period the results are likely to be disappointing. None of the regular scab sprays should be omitted.

The value of a ground spray is lessened when adjacent or nearby orchards with much scab are not similarly treated.

Use Elgetol or Krenite at the rate of 1/2 gallon in 100 gallons. Apply 500 to 600 gallons per acre covering all the ground area and extending a short distance beyond the outside trees. It is important that all the old leaves be thoroughly wetted. Spraying across the orchard in two directions usually will insure more complete wetting.

A good time to apply the spray is from the time the buds begin to swell until the green tip stage. Do not delay later than when the ends of the buds begin to open.

## Pre-Blossom Sprays

Spraying should begin in most parts of the state as soon as the buds are open enough that the tight cluster of blossom buds inside are visible and should be completed before any of the petals show or the blossom buds begin to separate. Start on the more scab susceptible varieties. It is important to apply this spray in the early tight cluster stage to obtain protection in seasons of early scab infection. Very much early season infection makes satisfactory scab control difficult if not impossible when weather conditions later become favorable for the development of the disease.

Sulfur at present is the most extensively used fungicide for the control of apple scab. It may be used in the combined form as liquid and dry lime sulfur, or as elemental sulfur such as the flotation sulfur pastes and high grade microfine wetttable powders - 5 microns or less. The coarser, milled sulfurs are not satisfactory on apples.

A number of organic fungicides have been developed in recent years. Of those tested under Missouri conditions, the two most promising ones at present considering injury and scab control, are Fermate and Puratized Agricultural Spray.

1. The lime sulfurs, liquid and dry, are more efficient fungicides than the wettable sulfurs and, therefore, are more effective in difficult scab situations. They are eradicant as well as protective fungicides. Lime sulfur, besides sticking better than the wettable sulfurs, will eradicate scab when it is applied as long as two days after infections have started and is effective in "burning out" established lesions.

The lime sulfurs, however, are objectionable because of the injury they so often cause. Injury is especially likely to be great when they are applied to wet foliage, when the humidity is high, or when applied after a period of cloudy weather. These are times when it may be important to put on a spray for scab control.

For a lime sulfur program in the pre-blossom period, use liquid lime sulfur in the early pre-pink stage at the rate of 2 to 2 1/2 gallons in 100, or 8 to 9 lbs. of dry lime sulfur where the convenience of this material is desired. Approximately 4 lbs. of dry lime sulfur is equivalent to 1 gallon of liquid lime sulfur for the control of apple scab. Start the second application when most of the blossom buds have separated using liquid lime sulfur at 2-100 or dry lime sulfur at 8-100 and continue spraying into early bloom if necessary to cover the orchard. A change to wettable sulfur is suggested where it is necessary to spray very far into the bloom period. There is risk of lime sulfur appreciably reducing the crop when used at this stage. Use flotation sulfur paste at the rate of 12 to 14 lbs. or a microfine wettable powder at 6 to 8 lbs. in 100 gallons.

In some seasons a modification in this program may need to be made. With open warm weather plant development may progress so rapidly that there will be time for only one and a partial second application, especially if the first spray is not applied early. When early season growth is unusually slow a third or partial third pre-blossom spray may be needed. Any extra spray should preferably be a microfine wettable sulfur. It is not desirable to apply two lime sulfur sprays within eight days of one another.

It is important that all trees receive a spray after the blossom buds have separated in order to extend protection well into or through the bloom period.

It is desirable not to use lime sulfur on Jonathan and Golden Delicious in the open cluster and later sprays.

2. The wettable sulfurs are far less injurious than the lime sulfurs and for that reason are coming more and more into use for the control of apple scab. Spray injury is a factor in securing maximum yields of quality fruit. Because of the injury factor the wettable sulfurs, in general, are to be preferred to lime sulfur where growers have facilities for rapid spraying to maintain coverage.

Where the "carry-over" of scab on the old leaves has not been unusually high, the wettable sulfurs properly applied have given good control of apple scab.

A mild sulfur program should not be undertaken unless it is possible to apply sprays on an 8-day or shorter interval which means not more than 4 or 5 days of actual spraying time.

The use of wettable sulfurs is necessary when certain other materials are to be used in the same application such as hexaethyltetraphosphate for aphids, benzenehexachloride for leaf roller and curculio, or where Fermate or Karbam is to be used for the control of cedar rust since these materials are not compatible with lime sulfur.

Use flotation sulfur paste at the rate of 12 to 14 lbs. or wettable microfine sulfurs at the rate of about 8 lbs. in 100 gallons. Begin spraying in the early tight blossom cluster stage and continue at about weekly intervals into the earlier part of the bloom period. Special attention should be given to the tops and top-centers of the trees, spraying until run-off begins. One pound of hydrated lime to the 100 gallons of spray increases the adhesiveness of wettable sulfurs.

3. Puratized Agricultural Spray has shown considerable promise against scab in our tests of the past two years but being a new material it has not been fully evaluated. This should be kept in mind when considering it for use. Comments on it and suggestions for its use are based on present information.

Puratized (5% active) at 1 pint in 100 gallons has caused no visible injury to any of the more common apple varieties of this section but an occasional variety has been found sensitive to it. It has caused no injury at 1 1/2 pints in 100 gallons in our tests when used in only the early season sprays at about 10-day intervals. Injuries have been reported at higher concentrations and might occur at the regular dosage rate where several applications are made at short intervals without intervening rains. The material, however, caused some dropping of scab infected leaves when it was applied to trees where scab had become established.

Puratized is considered very effective when present at the time infection occurs. It has shown an eradicant quality which in some cases has been about the equal of lime sulfur but the value of Puratized in checking scab after the disease has become established has not been fully determined.

A weakness of Puratized is that it is none too persistent and, therefore, probably should be used at relatively short intervals especially during rainy periods or in combination with more persistent protective fungicides. It has been used with good results in combination with some of the wettable sulfurs and Fermate, but not all the sulfurs. Information on these combinations, however, is limited to a few tests.

Do not use Puratized in combination with lime or with any materials containing lime such as the lime sulfurs. It should not be used with summer oils, dirty water or any material containing clay.

Our analyses this year show no mercury residue where Puratized at the rate of 1 pint in 100 gallons was applied in only the pre-bloom sprays. There was only an occasional small amount where calyx or calyx and first cover applications were made. These residues were probably in the calyx tubes where the mercury was not washed out before the calyx cups closed. Present information indicates that the greatest risk of residue from early applications is from a calyx spray.

Puratized might be used in all the pre-blossom sprays or be preceded by lime sulfur or preferably a wettable sulfur in the tight cluster spray. It probably could be best used after bloom to inactivate scab where earlier sprays have failed to control the disease. The suggested rate at present is 1 pint in 100 gallons. By combining it with a suitable wettable sulfur the period of protection may be extended. Two of the sulfurs with which it has so far been used successfully are "Mike" and "Micronized".

4. Fermate in general has been found to be about the equivalent of wettable sulfur in the control of apple scab. It is more effective as an afterbloom than as a pre-blossom spray and its inclusion in the pre-blossom period is suggested only for the control of cedar rust.

The first application should be made at the pink or open cluster stage of flower development using a minimum of  $3/4$  lb. in 100 gallons. Where cedar rust may be severe use at least 1 lb. of Fermate. At these dilutions Fermate must be supplemented with wettable sulfur for scab control. With Fermate at  $3/4$  lb. it is suggested that it be combined with wettable sulfur at  $1/2$  to  $2/3$  the regular rate of use. When using Fermate at 1 lb. add sulfur at  $1/3$  to  $1/2$  the regular rate.

Karbam is based on the same toxicant as Fermate but has not been tested as extensively. It is suggested that Karbam be used at the same rate as Fermate.

## Blossom Sprays

Where the last pre-blossom spray was applied before the buds reached the full pink condition or the blooming period is prolonged and rainy, a blossom spray is advisable. Where mild fungicides are being used or where it is felt that adequate protection has not been provided by the earlier sprays more protection can be gained by applying a wettable sulfur near the end of the bloom period. Unless the bloom is light three or four days of good pollinating weather at the time of fullest bloom is usually adequate for the set of a crop. Consideration, however, should be given to the time of blooming of different varieties in relation to cross pollination.

For scab control use about 10 lbs. of flotation sulfur paste or 5 to 6 lbs. of wettable sulfur.

For cedar rust and apple scab on cedar rust susceptible varieties use  $3/4$  lb. Fermate or Karbam and 3 lbs. of wettable sulfur or 6 lbs. flotation sulfur paste. Unless 1 lb. or more of Fermate was used in a late pre-blossom spray and the blooming period is short a Fermate-sulfur combination is advisable where cedar rust is a threat.

A 2-4-100 Bordeaux applied when about one-fourth of the blossoms are out sometimes reduces blossom blight but because of the uncertainty of control, the sporadic appearance of blight and the severe fruit russetting it often causes on copper sensitive varieties, such a spray is of doubtful value.

Leave insecticides out of all blossom sprays.

## Petal Fall or Calyx Spray

This spray ordinarily is started as soon as most of the petals have fallen but the timing may be varied some, depending upon when the last spray was applied. If there is much scab on the earlier leaves -- the blossom cluster leaves -- lime sulfur may be used to burn it out. Dry lime sulfur is safer from the standpoint of arsenical russeting of the fruit than liquid lime sulfur. If scab has been well controlled use a wettable sulfur, Fermate or Karbam. Fermate is quite effective in preventing scab infections but does not stop infections once they have started. It is an effective arsenical safener at 1 1/2 lbs. on apples.

Fermate or Karbam alone or in combination with wettable sulfur should be used for additional control of cedar rust where cedar rust is a problem.

Combine the fungicides with lead arsenate for the control of codling moth, curculio and red-banded leaf roller as follows:

1. Dry lime sulfur at 6 to 7 lbs. or liquid lime sulfur at about 1 1/2 gals. in 100 plus 3 lbs. of lead arsenate and 3 or 4 lbs. of fresh hydrated lime.
- or 2. Wettable sulfur at 6 to 8 lbs. to 100 gals. or about 12 lbs. of flotation sulfur paste plus 3 lbs. of lead arsenate.
- or 3. Fermate at 1 1/2 lbs. plus 3 lbs. of lead arsenate.
- or 4. Fermate 3/4 to 1 lb. in combination with wettable sulfur plus 3 lbs. of lead arsenate. With 3/4 lb. of Fermate use wettable sulfur at 1/2 to 2/3 regular rate; with 1 lb. of Fermate add 1/3 to 1/2 the regular amount of wettable sulfur.

## Cover Sprays

**Fungicides:** - Fungicides should be included in the first cover spray. With rainy weather favorable for scab or if lesions are present on the foliage, include a fungicide in the second cover. By this time primary scab infection is usually over and if the foliage is clean there is not likely to be any trouble from scab; but, if scab is present, continue with a fungicide as long as conditions are favorable for its spread and development. Where cedar rust is a problem use Fermate or Karbam or combinations of them with wettable sulfur in the first and second covers.

- Use: 1. Wettable sulfur 4 to 6 lbs. in 100 gals.  
 -- or 2. Fermate 1 to 1 1/2 lbs. in 100 gals.  
 -- or 3. A Fermate-wettable sulfur combination.

Fermate is an excellent scab fungicide in the cover sprays. It is safer than sulfur if late scab sprays are needed when high temperatures may be expected at any time. Being compatible with oil, Fermate can be used in one or two sprays immediately preceding an application of oil. Sulfur should not be used within three and preferably four weeks of an oil spray. Although oil and Fermate are compatible it is not advisable to use them together after the apples are very large since such combinations leave a black residue that is difficult if not impossible to remove.

**Insecticides:** - Three types of spray schedules are suggested which may be modified to meet the needs of the season and of the individual orchard.

Program No. 1. - Lead Arsenate - Nicotine and Oil

This program is for use where the codling moth problem is not severe and where the grower wishes to avoid a mite problem.

An 8 to 10 day schedule should be followed until the peak of the second brood which is usually in mid-July.

Use lead arsenate as the insecticide at 3 lbs. per 100 gals. in the first and second covers plus Fermate or wettable sulfur as suggested at the beginning of the cover spray program.

Use 3 to 4 lbs. of lead arsenate plus 1-1-100 zinc lime as an arsenical safener in the third cover. The zinc lime mixture is not needed if Fermate is included in this or the preceding spray.

Change to a nicotine and oil program at the last cover spray for the first brood codling moth (usually the 4th or 5th cover) using either (a) fixed nicotine and oil or (b) tank mix nicotine and oil.

- (a) For fixed nicotine and oil use 3 lbs. of a fixed nicotine and 2 qts. of summer oil for the first application of nicotine and oil. Use 2 lbs. of fixed nicotine and two quarts of oil for later sprays except applications made within 4 or 5 weeks of harvest. For the later applications reduce the oil to one quart.
- (b) For tank mix nicotine and bentonite, start with 6 lbs. of Mississippi bentonite, 3/4 to 1 pint of 40% nicotine sulfate and 2 quarts of summer oil. Continue with this combination as long as needed for codling moth control except that sprays applied within 5 weeks of harvest should have only 4 lbs. of bentonite and 1 quart of oil to 100 gallons of water.

Program No. 2 - DDT - Nicotine and Oil

This program is designed to give maximum codling moth control through the peak of the second brood. It may be modified to meet the needs of the season. If red spiders or European red mites become a problem in early July it may be necessary to change to nicotine and oil a week or two earlier than is indicated in the following schedule. Follow a schedule of 8 to 10 day intervals through the peak of the second brood.

First Cover - Use lead arsenate 3 lbs. plus a fungicide as suggested at the head of the Cover Spray program.

Second Cover - Use lead arsenate 2 lbs. and DDT (50%) 1 pound plus fungicide if needed.

Use 2 lbs. of 50% DDT in the third cover and continue through the peak of the second brood which usually is reached about mid-July. Then change to nicotine and oil using either the fixed nicotine and oil program or the tank mix nicotine and oil program as outlined in Program No. 1.

Program No. 3 - Full DDT Program

This program is suggested for use where maximum codling moth control is desired. It also presents the greatest possibility for injury from mites. Therefore, preparation should be made to apply a spray directed at

mite control when there is any indication of a decided build up in mite populations. Follow an 8 to 10 day schedule through the peak of second brood and then go to a 14 day interval.

**First Cover** - 3 pounds of lead arsenate plus a fungicide as suggested at the head of the cover spray program.

**Second Cover** - 2 pounds of lead arsenate and 2 pounds of 50% DDT plus fungicide if needed.

Beginning with the third cover and continuing till mid-July use 2 lbs. of 50% DDT. Reduce the DDT to 1 1/2 lbs. after mid-July. Do not apply DDT sprays later than thirty days before harvest. For further suggestions for red-banded leaf roller control see page 10.

## Mite Control

The mite problem where a DDT program has been followed, has not been solved in an entirely satisfactory manner to date.

Where an early DDT program is followed by nicotine and oil the mites and spiders will likely be reduced enough to prevent appreciable injury in most cases.

### For Red Spider Control

Special applications of one of the following materials may be used for red spider control:

1. DN-111 at 3/4 pound per 100 gallons.
2. Hexaethyl tetraphosphate at manufacturer's recommendations and precautions.
3. Summer oil at 3 quarts per 100 gallons.
4. 1 1/2 pounds of microfine sulfur or its equivalent during the fore part of the season when temperatures are not above 90 degrees Fahrenheit.

One or two special applications of 1 1/2 pounds of sulfur has given good red spider control. Spraying the tree from the inside only, will give maximum red spider control with minimum risk of sulfur burn. Such special applications of sulfur where there is no appreciable sulfur residue from earlier sprays appears reasonably safe at high summer temperatures.

### Controls for European Red Mites

1. Dormant or delayed dormant oil at 3 to 4 per cent.
2. DN-111 at 1 1/4 pounds per 100 gallons applied when the temperature is not above 95 degrees Fahrenheit.
3. Hexaethyl tetraphosphate at manufacturer's recommendations.
4. 1 per cent summer oil.

**CAUTION:** Do not combine DN-111 and oil. If one of these materials follows the other an interval of about two weeks should be allowed.

5. See page 12 for discussion on Parathione (3422).

## Red-Banded Leaf Roller

The red-banded leaf roller was an important problem in only a few Missouri orchards in 1947. Results during the past season would indicate that the use of 2 to 3 lbs. of lead arsenate in the calyx and first two covers gave satisfactory control of the red-banded leaf roller where it had not been a serious problem the previous year. Where an infestation develops later in the season an application of 3 pounds of lead arsenate directed at the under sides of the leaves and sprayed from inside the tree will give satisfactory control if properly timed and applied. The application should be made at the time a large number of the second brood larvae are small and feeding on the under sides of the leaves. In 1947 the time for this spray in central Missouri was the second week in July.

Where the red-banded leaf rollers have been a serious problem the past season the use of 3 pounds of lead arsenate in the cluster bud, calyx and first three cover sprays should give satisfactory control. Where the red-banded leaf roller is known to be a problem the early lead sprays should be applied in such a manner as to thoroughly cover the under sides of the leaves.

## Grasshopper Control in the Orchard

Where the whole orchard or large blocks of it are heavily infested with grasshoppers, orchardists will find the sodium-fluosilicate-sawdust-bran bait effective. The materials, either mixed or unmixed, may be secured from the local county agent. Six pounds of sodium fluosilicate is used to each 100 pounds of the dry mix, which is 1 pound bran to each 3 pounds of sawdust. See your county agent for information as to availability of supplies and for directions.

Chlordane at the rate of 1 pound of the actual material per acre in the form of either a 5 per cent dust, or as a spray using either the liquid or the wettable powder has given good control of grasshoppers for the past two years. One pound of the actual material per 100 gallons applied at the rate of 100 gallons per acre will give good results on orchards having a cover crop of moderate growth. 150 gallons per acre may be required for a heavier than average cover of vegetation.

The use of chlordane is still in the experimental stage from the standpoint of its effect on animals and man. Anyone using this material should observe extreme caution to avoid breathing the dust or spray. Direct contact with the skin and respiratory system should be avoided. Applications should not be made on crops to be used as food for man or animals within about two months of the time of application.

Toxaphene at the rate of 2 to 3 pounds of actual material per acre either as a dust or a spray has been reported by the USDA as being effective for grasshopper control.

Benzene hexachloride at two pounds of the 6% gamma material per acre, either as a dust or as a spray, gave good results in 1947 on young grasshoppers. It was not as effective on mature hoppers.

## Apple Blotch Control

A 12-12-100 Bordeaux with 1 gallon of Dendrol applied just as the buds are opening but before the blossom clusters inside become exposed is of value in controlling apple blotch by reducing the number of seedlike spores produced in the twig cankers. The efficiency of the spray depends upon the thoroughness of coverage. It is important to saturate the cankers on the lower as well as the upper sides. The later the spray is applied the longer the effect will extend into the summer but delaying too long increases the amount of copper injury. Only those fungous structures that are at the more advanced stage of spore production are affected.

Begin summer blotch sprays about 10 days after petal fall, using, preferably, Fermate or Karbam at the rate of 1 1/2 lbs. in 100 gallons. Fermate has been found to be just as effective as Bordeaux; in fact, there is indication that it is a little more effective, and it is far less injurious. For Bordeaux use 2-4-100 in the earlier sprays, increasing the strength to 4-6-100 in the later applications when there is less risk of copper burn.

On Duchess 3 and in extended seasons 4 applications should be made for blotch control. On later maturing varieties 4 or 5 cover sprays are usually sufficient.

In the earlier sprays Fermate may be combined with lead arsenate or DDT. Do not use it with lead arsenate after the third spray on the later maturing varieties because of its effect in reducing the efficiency of lead arsenate against codling moth. It may then be used with DDT.

## Bitter Rot Control

Sprays for bitter rot control should begin about 5 or 6 weeks after petal fall where this disease has been a problem. From 4 to 5 applications should be made at about 10-day intervals. Bordeaux 4-6-100 has been the standard fungicide but very promising results have been obtained with Fermate at 1 1/2 lbs. in 100 gallons. Each of these fungicides restricts the insecticide that can be used.

Bordeaux can be used with lead arsenate or DDT but not with nicotine and oil.

Fermate can be used with DDT but should not be used with lead arsenate since Fermate lowers the efficiency of lead arsenate against codling moth. While Fermate is chemically compatible with nicotine and oil the application of this combination in the latter part of the season leaves an objectionable black residue on the fruit that cannot be removed by ordinary treatments and sometimes causes fruit and foliage injury.

## Benzene Hexachloride

Benzene hexachloride has been found to be effective against curculio and the red-banded leaf roller, and as an early season spray offers the possibility of avoiding arsenical fruit russetting so often induced by lead arsenate. Use of BHC is questionable later than about one month after petal fall because of the possibility of its imparting an off-flavor to

the fruit. It should not be used with lime sulfur or any material containing lime. It is compatible with wettable sulfur.

## **Parathione (3422)**

Parathione has been reported by several state and Federal workers to be one of the most promising new chemicals for use in controlling European red mites and red spiders as well as a number of other insect pests. It has been used at the rate of 1/2 pound of the 15% wettable powder to 100 gallons. This material in the concentrated liquid form is very toxic to animals, being readily absorbed through the skin. The low concentration of the powder form is much less toxic than the concentrated liquid.

The operator should observe caution in using any material that has such high toxicity as Parathione.

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