

Missouri Apple Spraying;

Recommendations for 1934

Designed Especially for Commercial Orchardists

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Formulated in conference of fruit growers and Station workers of the Departments of Horticulture and Entomology of the University of Missouri, College of Agriculture, at Independence and Marionville, March, 1934.

DORMANT OR DELAYED DORMANT SPRAY

Generally most satisfactory as buds are swelling in the spring.

Home-made oil emulsions 2% (3 gallons emulsion—100); commercial oil emulsions or miscible oils used according to directions have been found quite satisfactory. Miscible oils more convenient if price is in line with emulsions. When scale is severe 3% oil (4½ gals.-100 home-made and Government formula emulsions) will be better.

Lime sulfur 12½ gals.-100 is satisfactory but more expensive than home-made oil emulsions.

This spray may generally be made without injury to buds or young leaves up until after swelling of the buds. It is most effective when buds are swelling, and at that time will also kill some aphids.

If scale insects are not present this spray may be omitted; when localized, infested areas only need be sprayed.

As a *dormant* spray to destroy scale and aphid eggs, one-half gallon of cresylic acid of the following approximate analysis may be used: Benzophenol 2% by weight, cresols 8-18% by weight, zyleneols 80-90% by weight, to 100 gallons of lubricating oil emulsions of the Government formula. Commercial dormant oils containing cresylic acid may be used. Tar oils to kill aphid eggs may be used where experience indicates they may be applied with satisfactory results.

SPECIAL APHID SPRAY

In most seasons and orchards, an aphid spray is of doubtful benefit. When rosy apple aphid infestation is anticipated, and the dormant spray against aphid eggs was not made, 2% oil emulsion (3 gals.-100) with 1 pint nicotine sulfate or lime sulfur $2\frac{1}{2}$ gals.-100 with 1 pint nicotine sulfate are fairly satisfactory. With the long hatching period of the rosy aphid, delay spray until buds begin to break but are not open enough to provide shelter for the aphids.

CLUSTER BUD SPRAY

TIME OF APPLICATION.—After clusters are open but before the blossoms open.

MATERIALS: Lime sulfur solution is the cheaper material, but dry lime sulfur may be used.

DILUTION:

Scab-susceptible Varieties
Lime sulfur solution $2\frac{1}{2}$ gals. to 100
or dry lime sulfur 8-9 lbs.-100.

Some Scab-susceptible Varieties
Black Twig
Ben Davis
Gano
Jonathan foliage
Delicious
Wealthy
Rome
Stayman

Scab-resistant Varieties
Lime sulfur solution 2- $2\frac{1}{2}$ gals. to 100
or dry lime sulfur 7-8 lbs.-100.

Some Scab-resistant Varieties
Jonathan fruit
Transparent
Grimes
Duchess
York
Ingram
Golden Delicious

Remarks

Cluster spray aids in black rot control.

Cool cloudy weather with intermittent rains most favorable to scab.

Period of heaviest infections usually ends 2 to 3 weeks after petal fall. With warm and drier weather, infections decrease. Cluster bud and calyx most important scab sprays.

Lead arsenate rarely needed in this spray and when omitted liquid lime sulfur probably will cause no more fruit russetting than dry lime sulfur.

Lead arsenate 2 or 3 lbs.-100 used by some growers who feel that they reach a few early curculio feeding on the foliage, but when curculio is a serious problem a special curculio spray will also be needed. See page 7.

If the cluster bud spray is applied early and the blooming season prolonged by cool weather with rains a supplementary spray for scab before the calyx spray may aid in checking scab.

CALYX OR PETAL FALL SPRAY

TIME OF APPLICATION: Start when bloom is two-thirds to three-fourths off and finish before calyx cups close.

MATERIALS:

Insecticides

Lead arsenate 2 lbs.-100.

Lead arsenate 3 lbs.-100 may be used if the grower is willing to risk the injury from arsenic which, on Jonathan, Ben Davis and Ingram, is sometimes appreciable. The use of 1 or 2 lbs. of fresh hydrated lime for each pound of lead arsenate will reduce the risk from injury but will lower the efficiency of the poison against codling moth.

Fungicides

Dry lime sulfur is better for finish. Liquid lime sulfur is the cheaper material.

Scab-susceptible Varieties

Dry lime sulfur 7-8 lbs.-100. Liquid lime sulfur 1¾-2½ gals. to 100.

Scab-resistant Varieties

Dry lime sulfur 6-7 lbs.-100. Liquid lime sulfur 1½-2 gals. to 100. Lime sulfur substitutes may be used if it is felt that the risk with scab or frog-eye is not great.

If conditions have been favorable for scab since the cluster spray, or scab has been a problem in previous years, the stronger dilutions are recommended; if the weather has been unfavorable and scab negligible, the weaker concentrations might fairly safely be risked.

Black Rot (Frog-eye).—This is an important spray for this disease.

Codling Moth.—This is the first spray of the season directed against the codling moth. It is important that it be made timely and thoroughly. Special emphasis should be given to the control of first brood worms.

Special Curculio Spray.—See page 7.

FIRST COVER SPRAY

TIME OF APPLICATION: Not later than 14 days after calyx spray.

MATERIALS:

Insecticides

1. Lead arsenate 2 lbs.-100 when codling moth is not an acute problem. The use of 2 or 3 lbs. of fresh hydrated lime is advisable should the fungicide be omitted.

OR

2. Lead arsenate as high as 3 or 4 lbs.-100 may be used when codling moth is serious, but there is risk of arsenical injury. Four

to 6 lbs. fresh hydrated lime should be used with such strong concentrations to decrease injury. If Bordeaux is used for apple blotch control, extra lime will not be needed.

Fungicides

When blotch is absent or light use dry lime sulfur for better finish; liquid for cheaper material.

Scab-susceptible Varieties

Dry lime sulfur 6-8 lbs.-100. Liquid lime sulfur $1\frac{1}{2}$ to 2 gals. to 100. Favorable scab weather since calyx spray, use stronger mixture; unfavorable, use weaker mixture.

Scab-resistant Varieties

Dry lime sulfur 5-7 lbs.-100. Liquid lime sulfur $1\frac{1}{2}$ -2 gals to 100 or lime sulfur substitutes. Dilution according to weather since calyx spray. With dry season and frog-eye unimportant the fungicide sometimes can be omitted.

When blotch is moderate to severe use Bordeaux (4 lbs. copper sulfate, 6 lbs. stone lime or 8 lbs. fresh hydrated lime for each 100 gals.) and apply the spray in 10-12 days after the regular calyx spray.

Black Rot (Frog-eye).—An important black rot spray especially with rains. Black rot spread mostly by rains. Keeping trees open, pruned and fertilized to promote strong growth will reduce the black rot problem. Usually it is a small problem in young orchards.

SECOND COVER SPRAY

PEAK CODLING MOTH EMERGENCE SPRAY

TIME OF APPLICATION: Not later than two weeks after the first cover spray when needed for scab or blotch. If directed primarily against codling moth, time according to emergence. Normally this is 12-16 days after first cover spray

MATERIALS:

Insecticides

1. Lead arsenate 2 lbs.-100 when codling moth is not an acute problem. The use of 2 or 3 lbs. of fresh hydrated lime is advisable should the fungicide be omitted.

OR

2. Lead arsenate 3 lbs.-100 with 1 gal. of summer oil or $\frac{1}{2}$ gal. dormant oil emulsion may be used when codling moth infestation promises to be heavy. It should be remembered that although more expensive, the margin of safety is greater with the summer or white oils than with the dormant oils and there is considerable risk of injury when oil stocks containing soap are used with lead arsenate. To aid in removal, 3 or 4 lbs. of hydrated lime or 4-6-100 Bordeaux may be

used in the lead-oil combination except that lime must not be used with the oil stocks containing soap.

OR

3. Lead arsenate as high as 3 or preferably 4 lbs. to 100 may be used when codling moth is serious but there is risk of arsenical injury. Four to 6 lbs. fresh hydrated lime or Bordeaux should be used with such strong concentrations to decrease injury.

Fungicides

Scab Only.—A fungicide at this time is often unnecessary for scab. If rains have been occurring, use dry lime sulfur 5-7 lbs. to 100 or lime sulfur substitutes. If scab lesions are rather numerous on the leaves, a light fungicide at this time is advisable to reduce secondary infections which are likely to occur following every shower. CAUTION: Bordeaux (4 lbs. copper sulfate, stone lime 6 lbs. or fresh hydrated lime 8 lbs.-100 gal.) must be substituted in place of sulfur sprays if the lead-oil combination is used.

Blotch.—Use Bordeaux (4 lbs. copper sulfate, 6 lbs. stone lime or 8 lbs. fresh hydrated lime to 100 gals.) where apple blotch is serious.

Black Rot.—Dry lime sulfur, liquid lime sulfur or Bordeaux, as for scab or blotch. A spray at this time will aid in the control but only in rather rainy seasons does it seem advisable to use a fungicide especially for black rot.

NOTE: When scab and blotch are serious, it is important especially up to this time that the intervals between sprays be no longer than 14 days.

THIRD COVER SPRAY

TIME OF APPLICATION: Allow an interval of about 18 days between the second and third cover and then follow with the first July spray in about 18 to 21 days; or apply the third cover 12-14 days after the second and then in 12-14 days put on an extra supplementary first brood spray, which will be followed in about two weeks by the usual fourth or first July spray. Where the grower is controlling his worms satisfactorily, he should not put on the supplementary spray, but where for any reason he is not controlling them he may find the extra spray helpful. The timely notes on moth activity sent out during the summer will be of further help to the grower in timing these sprays, but where codling moth is serious it is important to keep the surface of the fruit thoroughly covered at all times.

MATERIALS:

Insecticides

Lead arsenate used as recommended for Second Cover Spray.

Fungicides

Fungicides not needed unless blotch is a problem. Then use Bordeaux (4 lbs. copper sulfate, 6 lbs. stone lime or 8 lbs. fresh hydrated lime for each 100 gals.)

NOTE: Bitter rot seldom appears in North Missouri and is localized in South Missouri. When present to the extent to require sprays, use Bordeaux same strength as for blotch, applying the latter part of June, and follow with three more applications at 2-week intervals.

FOURTH COVER SPRAY

(Early July)

TIME OF APPLICATION: Depends upon emergence of codling moth Applied early in July, not longer than 18 to 21 days after third cover spray.

MATERIALS:

Insecticides

1. Lead arsenate used at the rate of 3 lbs.-100. Fresh hydrated lime, 1 lb. for each pound of lead arsenate may or may not be used. The use of lime leaves a heavier deposit on the fruit and reduces the efficiency of the lead arsenate, but reduces danger of burning (omit additional lime if used with Bordeaux). Fresh hydrated lime is advisable in this spray.

2. The oil-lead combination given in Second Cover Spray may be used in this application if codling moth is serious, but it is not generally recommended.

Fungicides

Use Bordeaux as previously stated, when blotch or bitter rot has been severe.

FIFTH COVER SPRAY

(Latter half of July)

TIME OF APPLICATION: About 2 weeks after Fourth Cover Spray.

MATERIALS: Lead arsenate 3 lbs.-100 if codling moth is a problem— with or without hydrated lime (Omit additional lime if used with Bordeaux). The heavier use of lead arsenate in this and the later sprays increases the residue problem and the danger of spray injury. Residue is not as serious, however, as codling moth injury.

LATER SPRAYS

Codling Moth: Where the codling moth is serious, two additional sprays at about 14 to 16 days intervals, depending upon moth activity, made during early August and the latter half of August should be applied on late varieties.

MATERIALS: Lead arsenate 2 or 3 lbs.-100 with 3 or 4 lbs. of hydrated lime.

SPECIAL CURCULIO SPRAY

(This Spray not Necessary in many Orchards)

TIME OF APPLICATION: About 7 days after petal fall spray.

MATERIALS:

Lead arsenate 3 lbs.-100.

When curculio is severe, a spray of lead arsenate 3 lbs.-100, with 3 to 6 lbs. of fresh hydrated lime, should be made within 7 days after the calyx spray. A sulfur fungicide may be used with the lead arsenate for scab and the first cover spray applied 10-12 days later. If the fungicide is not used in this spray, apply the first cover spray not later than 2 weeks after the calyx spray and Bordeaux is preferred when apple blotch is serious.

STUDY THESE SUPPLEMENTARY SUGGESTIONS

This schedule of sprays properly timed and applied if supplemented with scraping and banding and complete orchard and packing house sanitation should give effective control of the codling moth and other insects and diseases. It is also likely to give residue in excess of the tolerance, which will necessitate washing unless there is abundant rainfall prior to picking time. The following are the supplementary measures suggested:

1. Most lime sulfur substitutes are less injurious to fruit and foliage than liquid lime sulfur or dry lime sulfur during the spring. In the hot summer, sun-sulfur-scald is roughly proportional to the amount of sulfur applied, irrespective of the kind.

The use of lime sulfur substitutes except dry lime sulfur is not advised before the calyx spray and then only with the less susceptible scab varieties and in seasons not favorable to scab. With susceptible varieties, their use should be delayed until the Special Curculio or the First Cover Spray when the season is unfavorable to scab. Lime sulfur substitutes are of doubtful value against blotch.

2. In young bearing orchards and orchards where codling moth infestation is light and diseases not serious, the first, second, and

fourth cover sprays in addition to the cluster and calyx sprays may prove sufficient.

3. Sometimes an orchardist will omit the cluster spray, but the risk is greater than justified when it is considered that the cost of spraying is only a small fraction of the value of the crop. A few primary scab lesions at this time with later rains will increase many fold. The control of the primary infections is the secret of success.

4. On account of danger of injury to fruit and foliage, oil and sulfur-carrying sprays usually must not be applied within two weeks of one another and the greater the interval the greater the safety with which they may be used. The likelihood of injury by the use of sulfur in the cluster spray following a delayed dormant application of oil is not great even with a shorter interval than two weeks, provided the delayed dormant spray of oil is not applied after the leaves have grown out considerably.

5. Too much lead arsenate or lead arsenate and oil may cause not only injury to fruit or foliage but also difficulty in removing the material. The use of Bordeaux or lime assists in the removal.

6. When codling moth is serious, supplementary measures in addition to spraying are necessary. We recommend the full use of methods of control other than spraying, including scraping and banding, pruning to permit the most thorough spraying, thinning to remove wormy apples, the destruction of wormy windfalls and culls, screening packing sheds and complete orchard sanitation.

7. Thoroughness of spraying and timing according to seasonal variations are necessary and cannot be compensated for by use of more or different spraying materials.

8. For varieties like Golden Delicious, which are easily injured by the lime sulfur-lead arsenate combination, the use of the lime sulfur substitutes (other than dry lime sulfur) are advised after the cluster bud application.

9. In areas near packing sheds, the variation and greater emergence of moths may make supplementary spraying very important.

10. On account of spray residue, the application of sprays near the harvest period on summer varieties should be avoided unless conditions make necessary such a practice.

11. Sooty Blotch and fly speck may be controlled in rainy seasons and in locations favoring their development with one or two weak Bordeaux sprays applied during July and August.

12. Every orchard is an individual problem and must be treated as such. Consequently, for best results each grower must adapt the spraying suggestions to his particular needs.