

Apple Spray Program for Kentucky Fruit Growers

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This spray program is presented as the one most apt to control apple insects and diseases in Kentucky. It is based on recent research carried on in the Midwest by the Federal Fruit Insect Laboratory at Vincennes, Indiana, and the Kentucky, Illinois, and Indiana Agricultural Experiment Stations.

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SUCCESSFUL SPRAYING involves correct timing, thorough application, and use of proper materials. It should also be remembered that sanitary measures such as cleaning up trash, scraping and banding trees, screening packing sheds, and keeping picking crates free of worms, are just as important as the spray program in controlling insects and diseases.

In general, because of residue problems, no variety of apple should be sprayed later than 30 days before harvest. This means that such varieties as Yellow Transparent should receive not more than 2 cover sprays. Also, the summer applications of lead arsenate sprays on late apples to control second-brood codling moth may result in lead and arsenic residues above the legal tolerances.

DDT is included in the spray schedule this year as it has given the best codling moth control during the past 3 years. However, where DDT has been used instead of the older control materials there have almost always been outbreaks of European red mites or other mites difficult to control and sometimes outbreaks of red-banded leaf roller and certain species of aphids. Growers who have been able to control apple pests satisfactorily with schedules not containing DDT, may increase their problems if they switch to DDT.

Spray service work, under the Special Horticulture Appropriation, is being carried on in the main fruit sections of Kentucky. For help with your problems consult your spray letters, your County Agricultural Agent, or the Agricultural Experiment Station.

If you have only a few trees or wish to use only a minimum schedule, see Circular 353, "Sprays for the Home Fruit Garden."

For a detailed discussion of fruit insects and diseases in Kentucky, see Ky. Agr. Exp. Sta. Bulletin 393, "Fruit Pests and Their Control."

(This circular is a revision of Leaflet 10)

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Dormant Spray

In orchards where DDT was used last year, it is especially necessary that a dormant spray be applied this year to control mites.

When to apply: In early spring or late winter, before growth begins, and on a day when the temperature is above 45°F. If possible choose a bright clear day with little or no wind.

➔ **To control scale and mites (by killing mite eggs) use a spray containing 3 gallons of dormant spray oil per 100 gallons of spray mixture.**

Or

➔ **To control scale, mites, rosy aphids and other apple aphids (by killing aphid eggs) use in 100 gallons of spray mixture 3 gallons of a dormant spray oil containing one of the dinitro compounds.**

Some growers prefer to use commercial oil emulsion or miscible oil. Those preferring to make tank-mix emulsions can emulsify bulk spray oil¹ in the spray tank using calcium caseinate, soybean flour, lignite pitch, concentrated bordeaux mixture, or one of the commercial emulsifiers.

Emulsion with calcium caseinate.—For mixing 200 gallons of spray: Make a paste of 1 pound of calcium caseinate in a bucket with 2 quarts of water. Fill bucket gradually while stirring. Pour mixture into spray tank with enough warm water to operate pump. Start pump and allow discharge from open spray rod to shoot back into tank under full pressure. Add slowly 6 gallons of spray oil, continuing agitation, and pump for a few minutes. Fill tank with water and apply immediately.

Emulsion with bordeaux mixture.—Start agitator with 20 gallons of water in 200-gallon tank. Add 6 pounds of powdered bluestone and 6 pounds of hydrated lime. Allow discharge from spray rod to shoot back into tank under full pressure. Pour in slowly 6 gallons of spray oil, continuing agitation, and pump until thoroughly mixed. Fill tank with water and apply spray immediately.

¹ Use oil with the following specifications:

Viscosity at 100° F. 125 to 200 seconds saybolt
Volatility at 105° C. (221° F) not above 2 percent

Ground Spray for Scab Control

When to apply: As soon after January 1 as possible, and before any growth starts or any scab spores are discharged.

- Use 2 quarts Elgetol (one of the dinitro compounds) per 100 gallons of spray mixture. 300 to 500 gallons of spray mixture needed per acre.

A ground spray of Elgetol, applied before growth starts or scab spores begin to be discharged, has been found effective in reducing the amount of apple scab and making its control easier. Where much ground spraying is to be done a special boom attached to the rear of the sprayer is needed, with nozzles every foot. In this way, as the sprayer is driven between the rows of trees, the old apple leaves on the ground can be covered and the spore-producing bodies killed.

Prebloom Sprays

- **GREEN-TIP SPRAY:** On Red Delicious in rainy seasons apply a spray when the green tips of the leaves are first exposed. Use 2½ gallons of liquid lime sulfur in 100 gallons of spray mixture.
- **PRE-PINK SPRAY:** If wet weather prevailed during the green-tip stage this spray is needed on all varieties. Apply it just as the first leaves are unfolding around the blossom buds and before the clusters separate. Use 2 gallons of liquid lime sulfur in 100 gallons of spray mixture.
- **PINK SPRAY:** This is usually the most important scab spray and should never be omitted. Apply when the fruit buds are pink and the clusters are separated. Use 2 gallons of liquid lime sulfur in 100 gallons of spray mixture.

These prebloom sprays are primarily for the control of apple scab, which often causes more loss than all other diseases and insects combined. Failure of unsprayed orchards to set fruit in a rainy spring is often due to apple scab. Scab also attacks the leaves and may defoliate trees by early May. Red Delicious, Winesap, Rome Beauty, Stayman, and Golden Delicious are especially susceptible to scab.

The number of prebloom sprays required to give protection against scab varies with the season and the variety. In wet, cool springs more sprays are required because scab spores are released after rain and because spores germinate in wet weather. During prolonged

rainy periods one spray application will not protect fruit for longer than 6 or 7 days. At such times, when the ground is soft, growers who have power dusters may find it advantageous to use sulfur dusts instead of the sprays.

Quince- and cedar-rust control.— Orchards surrounded by or close to red cedar trees may lose considerable fruit and foliage from quince and cedar rust. The disease-producing fungi live on cedars in winter and transfer to apples by spores in early spring. Rome, York, Jonathan, Winter Banana, Red Delicious, and Stayman are quite susceptible; Golden Delicious and Grimes less so. Fermate, a new fungicide, gives good control of these two diseases and also helps control scab.

➔ Growers needing to control rust should use a mixture of $\frac{1}{2}$ pound Fermate and 3 pounds wettable sulfur per 100 gallons of spray mixture in all sprays from Pink to Calyx, instead of the other fungicides listed for those sprays. Also, in the first cover spray, substitute 1 pound Fermate for the wettable sulfur, especially if the season is wet.

Full-Bloom Spray

To control blossom blight. Needed on Transparent, Polly Eades, Jonathan, Wealthy, King David, and Grimes.

When to apply: Apply when one-third of the blossoms are open.

➔ Use 2-4-100 bordeaux mixture. (2 pounds copper sulfate, 4 pounds chemical hydrated lime made especially for spraying, in 100 gallons of water.)

How to mix bordeaux sprays.— In any bordeaux formula the first figure refers to pounds of copper sulfate (bluestone), the second to pounds of hydrated lime, and the third to gallons of water. The easiest way to prepare good bordeaux mixture is to wash copper sulfate powder through the screen into the spray tank as the tank is being filled with water and while the agitator is operating. When the tank is two-thirds full wash the required amount of hydrated lime through the screen into the tank while adding the rest of the water. Always use fresh, chemical hydrated lime made especially for spraying. Do not carry spray lime over from year to year.

Calyx Spray

To control codling moth and apple scab all orchards should have the calyx spray.

When to apply: When three-fourths of the petals are off. And in orchards where codling moth has caused severe losses it will pay to repeat this spray immediately (the same day if possible), spraying only the upper third of each tree.

- ➔ Use 3 pounds of lead arsenate, 3 pounds of hydrated spray lime, and 6 pounds of wettable sulfur in 100 gallons of water. To control quince and cedar rust substitute $\frac{1}{2}$ pound Fermate and 3 pounds wettable sulfur for the 3 pounds of lime and 6 pounds of wettable sulfur in the formula.

DDT - Lead Arsenate - Nicotine Spray Schedule for Problem Orchards

COVER SPRAYS

- ➔ **FIRST COVER SPRAY:** For curculio, codling moth, and scab. Apply 7 to 10 days after the calyx spray. Use 3 pounds of lead arsenate, 3 pounds of hydrated spray lime, and 6 pounds of wettable sulfur per 100 gallons of water. For quince and cedar rust, especially if the season is wet, substitute 1 pound Fermate for the lime and wettable sulfur.
- ➔ **SECOND COVER SPRAY:** A very important spray for codling moth control. Apply just before the first hatch of codling moth worms (usually 7 to 10 days after first cover spray). Check with Spray Service reports. Use 2 pounds lead arsenate, 8 ounces DDT (actual amount of DDT; not the amount of compound containing the DDT), and 3 pounds lime in 100 gallons of water. (For example, if the DDT material is 40-percent DDT, 20 ounces of it would give 8 ounces of actual DDT.) On blotch-susceptible varieties add 1 pound Fermate and leave out the lime.
- ➔ **THIRD COVER SPRAY:** Apply 10 days after second cover. Use 2 pounds of lead arsenate, 8 ounces (actual amount) of DDT, and 2 quarts of summer oil in 100 gallons of 1-2-100 bordeaux mixture.
- ➔ **FOURTH COVER SPRAY:** Apply 10 to 12 days after third cover and use same materials. If bitter rot has been a problem, increase the bordeaux to 4-6-100 (See discussion on page 7).
- ➔ **FIFTH COVER SPRAY:** Apply 10 to 14 days after fourth cover and use same materials as in third cover spray.

SUMMER SPRAYS

In some orchards it may be possible to omit some or all of the sprays for second-brood codling moth. Where DDT has been used, however, sprays for mite control may be necessary in July and August. If bitter rot has been a problem it will not be wise to shift to a DDT-fixed nicotine schedule (See below).

➔ **FIRST SUMMER SPRAY:** Apply 2 weeks after fifth cover, or consult Spray Service. Use 6 ounces actual DDT, 3 pounds of factory-processed nicotine bentonite (Black Leaf 155), 2 quarts summer oil, and 2 ounces soybean flour per 100 gallons of spray mixture. Make a thin paste of the soybean flour, allow to stand at least 10 minutes, then add to summer oil and pour this mixture into the tank when tank is nearly full. If mites are present, use instead $\frac{1}{2}$ pound DDT (actual) and $\frac{3}{4}$ pound DN-111 per 100 gallons spray mixture. This formula may cause foliage injury if the temperature is above 90° F. during the next 2 days.

➔ **SECOND SUMMER SPRAY:** Apply 2 to 3 weeks after first summer spray. Same materials as first summer spray.

➔ **THIRD SUMMER SPRAY:** Apply 2 to 3 weeks after second summer spray. Same materials as first summer spray.

• Additional sprays (same materials) may be needed in late August or in September if there is a third brood of codling moth or if mites become a problem.

BITTER ROT

Growers who had loss from bitter rot last year should apply 4-6-100 bordeaux about the middle of June (probably in fourth cover spray) and at 2-week intervals thereafter until 4 sprays have been applied. This rules out a shift to a fixed-nicotine-DDT schedule for codling moth. However, growers who have a codling-moth problem can use $\frac{1}{2}$ pound DDT (actual) and 4-6-100 in the summer sprays. In commercial orchards where the full schedule of first-brood cover sprays is followed, frequent use of weaker bordeaux as called for in the cover sprays should control bitter rot.

Growers should watch for the first appearance of bitter rot, and immediately hand-pick and destroy all spotted fruit, search out and remove the overwintering places, and spray the affected trees and neighboring trees. The overwintering places (old fruit stems, mummied fruits, cankers, and dead wood) will usually be found directly above the first rotted fruits.

LEAFHOPPER CONTROL

Leafhopper damage to foliage is usually controlled by DDT or fixed nicotine sprays. If other schedules are used and leafhoppers become numerous, apply $\frac{3}{4}$ pint of 40-percent nicotine sulfate per 100 gallons of spray mixture when the leafhopper nymphs are nearing maturity. Nicotine sulfate can be used in a regular codling-moth spray.

Lead Arsenate Spray Schedule for Light Codling Moth Infestation

The following schedule should be especially useful in Eastern Kentucky orchards where codling moth is not much of a problem and where there is always danger of bitter rot.

➔ **DORMANT through CALYX SPRAYS:** Same as in previous schedule, pages 3 to 6.

➔ **FIRST COVER SPRAY:** For curculio and scab. Apply 7 to 10 days after Calyx Spray. Use 4 pounds of lead arsenate, 3 pounds of hydrated spray lime, and 6 pounds of wettable sulfur per 100 gallons of spray mixture.

➔ **SECOND COVER SPRAY:** Apply 7 to 10 days after first cover spray (usually just before first hatch of codling moth worms). Use 4 pounds lead arsenate, 6 pounds wettable sulfur, and 2 pounds hydrated spray lime in 100 gallons of spray mixture. On varieties susceptible to blotch, sooty blotch and King David spot, use 4 pounds lead arsenate and 4-6-100 bordeaux instead.

➔ **THIRD COVER SPRAY:** Apply 2 weeks after second cover spray. Use 3 pounds lead arsenate and 4-6-100 bordeaux.

FIRST SUMMER SPRAY: Apply about July 10 in Eastern Kentucky (or consult Spray Service). Use 3 pounds lead arsenate and 4-6-100 bordeaux.

OTHER SUMMER SPRAYS: If bitter rot caused losses last year, apply 2 more sprays at 2-week intervals, using 4-6-100 bordeaux without lead arsenate.

Caution.—In some Eastern Kentucky orchards where a single application of bordeaux has been applied during the summer, there has been copper damage to foliage several weeks later, resulting in considerable loss of foliage and fruit drop. This has not occurred where several bordeaux applications have been made, probably because the additional lime combined with any excess copper. Therefore, if a single application of bordeaux is made, it is well to put on another spray a week or 10 days later, consisting of 5 pounds of lime per 100 gallons of water, as a safety measure.