

Petroleum Oil Spray Recommendations and Precautions in Their Use

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PETROLEUM oil sprays are now used effectively as insecticides as both dormant and summer sprays. They also function as spreaders or adhesive agents and as deposit builders in flocculated spray combinations. Field experimental tests carried on at the Hood River Branch Experiment Station and correlated with laboratory studies during the past 10 years emphasize the importance of selecting the proper oil spray, mixing in the spray tank by a definite procedure especially when in combination sprays, and using the recommended amount for the control of the particular insect pest. Equally important are time of application and thoroughness of the job.

Climatic conditions and severity of infestation may vary in different localities and, in fact, between different orchards in the same locality. General recommendations may, therefore, need to be modified to suit the purpose at hand. For example, a dormant oil spray may be applied safely in one locality during the critical period of bud development while in another it would be disastrous because of injury that may occur. Local authorities, then, should be consulted in the selection of the proper oil for the specific purpose needed and to learn the limitations of the various oil sprays available.

TYPES OF COMMERCIAL AND HOME-PREPARED OIL SPRAYS

In order to break up the oil mass so that it will disperse in water in the spray tank, substances known as emulsifiers are used. For this purpose numerous materials are suitable. Depending on the emulsifier used and the process of manufacture, many types of oil sprays may be produced. Some are stable emulsions and may not require special care in handling. Others are quick breaking so that the oil may separate from the emulsion and cause injury to the plant. To avoid chances for injury each kind must be mixed in the spray tank by following a definite procedure. Judged from the physical appearance of either dormant or summer oil spray preparations, directions may be given on procedure and precautions to take in mixing the sprays in the spray tank. These are listed as follows:

1. **The jelly type emulsion** is a thick emulsion containing 80 to 85 per cent oil, nearly white in color, depending on the purity of the oil used. It must be ladled from wide-mouthed containers. The jelly type of emulsion is intermediate in stability but usually no difficulty is experienced in handling it unless it has been allowed to freeze. The oil then separates and should not be used in that condition.

In order to mix the jelly emulsion in the spray tank, first add water until the agitator shaft is covered and then add the emulsion. Allow the agitator paddle to mix thoroughly the water and emulsion and then fill the tank with water. When used in combination sprays, it should

first be mixed with an equal amount of water and stirred or beaten with a wire whip to an even, thin consistency. It may then be poured into the spray tank when partly full or full, as the directions require.

2. **The flowable type emulsion** also contains 80 to 85 per cent oil and is similar in appearance to the jelly type except that it is not so thick and may be poured directly into the spray tank at the time indicated. Emulsions of this kind usually are more stable than other forms on the market and do not give quite as heavy a deposit of oil on the surface sprayed. When the flowable type is used in the summer as a foliage spray, however, it is preferable to stir in an equal amount of water before adding the emulsion to the spray tank.

Home-prepared oil emulsions are similar in appearance to the commercial flowable type. These emulsions owe their flowability, however, to the amount of water used in their preparation. They should be carefully prepared as directed in Oregon Experiment Station Bulletin 393. For most purposes the casein-ammonia emulsion formula is recommended. Procedure for mixing in the spray tank is the same as for the commercial flowable emulsions.

3. **Emulsive or soluble oil sprays** have the appearance of clear, pure oil. They contain emulsifiers that are soluble in the oil and do not change materially the physical appearance of it. About 97 to 99 per cent of these products is petroleum oil of either dormant or summer grade with 1 to 3 per cent soluble emulsifiers.

The emulsive oil sprays may be considered relatively unstable after dilution in the spray tank, with a tendency to separate in large oil drops and cream to the top. Unless properly mixed they may cause severe injury. This tendency may be overcome by the following procedure: Run water into the spray tank until the agitator shaft is covered, then add the required amount of the emulsive oil and with the agitator going full speed, pump the mixture back into the spray tank through the spray nozzle for at least a minute. The mixture turns white, which indicates good emulsification. Then fill the spray tank with water and apply immediately. It is most important that the speed of the agitator be maintained throughout the spraying operation. Laboratory tests show that some commercial brands are superior to others from the standpoint of stability of the emulsion after dilution in the spray tank. Not all brands may need to be repumped as described above, yet for safety the precaution is well worth taking for all brands.

4. **Home-prepared, tank-mixed oil sprays.** For dormant spraying purposes a home-prepared oil spray described as "Tank-Mix" has given excellent results. It is easily prepared in the tank at the time of spraying by adding a spreader, such as blood albumen, to the water and then pouring in the petroleum oil. It is very important that the following procedure be observed: The agitator should be geared to run at a speed of not less than 200 rpm and should be equipped with two additional flat, square-end agitator paddles. These paddles may be about 12 inches over all, depending on the distance of the shaft above the bottom of the spray tank, and may be attached near the other two propeller-type blades. For each 100 gallons of spray any of the following spreaders or dispersive agents may be used:

1. Two ounces blood albumen spreader stirred into a pint of water.

2. One and one-half ounces casein stirred into a pint of water containing a tablespoonful of ammonia.
3. Six ounces milk powder stirred into 1 pint of water containing 1 tablespoon of ammonia.
4. One and one-half ounces of any wetting agent* dissolved in 1 pint of water.

The procedure for mixing in the tank is as follows:

1. Fill the spray tank about one-third full with water and start agitator.
2. Add the required amount of one of the spreaders or dispersive agents.
3. Then add the required amount of oil and immediately fill the tank with water. The spray is now ready for application.

Precaution: It is most important that the agitator be run at full speed throughout the entire period of spraying.

DORMANT OIL SPRAYS

Petroleum oils for various purposes must meet definite specifications. These include purity as indicated by the sulphonation test and distillation range, which for practical purposes may be represented by viscosity. Oil suitable for dormant spraying may cause severe injury if used as foliage or summer spray.

Dormant oil specifications

One grade of oil only is necessary for all dormant spray emulsions. It should have a viscosity between 100 and 120 seconds Saybolt and a relatively low "sulphonation" test that may vary between 50 and 70. This grade of oil has been found effective and safe.

Dormant oil uses

1. For the control of San Jose scale, oyster shell scale, European red mite and brown mite, and fruit tree leaf-roller, the dormant oil should be used at the rate of 3.2 per cent actual oil (equivalent to about 4 gallons of commercial oil emulsion, 3.3 gallons of emulsive oil, or 5 gallons of home-prepared emulsion per 100 gallons of spray). When used as a delayed dormant spray, this amount of oil will also control apple aphid (except the woolly aphid).

2. When necessary to control anthracnose on apples, a bordeaux mixture, 6-6-100, plus oil, 4.2 per cent (about 5.0 gallons of the emulsion) will control the disease as well as the insect pests listed under 1. Prepare the tank of bordeaux as outlined in Oregon Experiment Station Bulletin 393 and then pour in the required amount of oil spray.

3. Some insect pests may be controlled effectively by either oil emulsions or lime sulphur when used as a dormant application. Which spray should be used depends on other insects or fungous diseases that may be controlled by the same spray. To limit the damage from certain pests or diseases, the dormant oil should be alternated with lime sulphur where advisable in order to hold in check the increase of those pests or diseases that may develop from the continued annual use of either oil or lime sulphur alone.

4. Oil emulsion (or lime sulphur) for scale insects should be applied in the spring, preferably before the bud scales separate and before the bud tips show green.

* Commercial wetting agents: Vatsol; Nacconol NR; Alkanol; and others carried by local dealers or by California Spray Chemical Corporation, Portland, Oregon, and Miller Products Company, Portland, Oregon.

5. Oil sprays may cause injury if applied during the critical period of bud development. This period occurs between the time the buds first show green and the cluster bud stage. The chance for injury is much greater if this period is followed by slow growing conditions due to cold weather. If a very stable oil emulsion is used during this critical period, the chances for injury are materially lowered. The emulsive type of oil should not be used. For information on stable emulsions available in the district, consult your local authorities.

6. The combination of dormant oil and lime sulphur is a comparatively recent development. The Washington State Experiment Station has demonstrated that dormant oil 1 per cent, combined with liquid lime sulphur 3 per cent, is more effective for San Jose scale control than either material used at dormant strength separately. The cost of this combination spray is much lower than when either oil or lime sulphur is used alone. During the past two years, studies have shown that when used on pears, dormant oil emulsion 2.5 per cent (actual oil 2 per cent) plus lime sulphur 6 per cent will control European red mite and pear aphid, and be effective as the first scab spray where this disease is a problem. It will also control blister mite and San Jose scale if present. On apples, the same combinations are effective for control of scale, aphid, and red mite. Until further information is available, the combination spray should be applied before the outer bud scales on the fruit buds drop. The mixture should be prepared as follows:

1. Add water to the spray tank until the agitator shaft is covered.
2. Add oil emulsion using the precautions emphasized above.
3. Fill the spray tank with water and when nearly full add the lime sulphur slowly. Apply immediately without stopping the agitator at any time.

SUMMER OIL SPRAYS

Oils that are suitable as summer or foliage sprays must be selected with great care. While for all practical purposes one oil fulfills the requirements for dormant spray purposes yet for summer spraying several are needed. A close-cut oil should be used and should meet definite specifications. The distillation range as expressed by viscosity, and the sulphonation test, or purity index, should be the basis for the selection of all foliage oil sprays.

Similar types or kinds of oil emulsion are available commercially as described previously. The same procedure should be followed in mixing these oils in the spray tank. Special care should be taken when the summer emulsive type oil is used to avoid spray injury.

When lime-sulphur or other sulphur sprays have been applied for scab control, oil sprays should not be applied until at least 40 days thereafter. Otherwise severe burn may result. Another precaution is not to let oil combinations with other sprays, such as lead arsenate or bordeaux, stand in the pipes of stationary outfits. As soon as a tankful of any oil emulsion has been prepared, it should be applied immediately and without stopping the machine at any time.

1. Summer oil specifications

For most purposes in Oregon, oils for summer spraying may be selected from three grades: "light," "light-medium," and "medium." Each of these grades should also meet the purity or sulphonation test of about 85. Heretofore oils of lower purity have been used, especially when 1 quart to 100 gallons of spray only is used. Both kerosene and stove oil, also, may be of lower purity, since these oils are used in relatively small amounts as spreaders or deposit builders.

The following specifications indicate the grades of oil recommended for summer spraying:

Light oil: 64 to 79 per cent of oil should distill at 636° F.

Viscosity about 55 seconds Saybolt at 100° F.

Sulphonation test not less than 85.

Light-medium oil: 52 to 61 per cent of oil should distill at 636° F.

Viscosity about 65 seconds Saybolt at 100° F.

Sulphonation test not less than 85.

Medium oil: 40 to 49 per cent of oil should distill at 636° F.

Viscosity about 75 seconds Saybolt at 100° F.

Sulphonation test not less than 85.

Kerosene: Viscosity about 32 seconds Saybolt at 100° F.

Sulphonation test about 80 or more.

Stove oil: Medium grade with relatively low sulphur content, available from most oil companies.

2. Oil sprays in codling moth control

Summer oil sprays are used in combination with other insecticides for codling moth control. In heavily infested orchards oil sprays may be used advantageously as an ovicide. For this purpose, a light-medium oil, $\frac{1}{2}$ gallon to 100 gallons in combination with lead arsenate, 3 pounds to 100, applied as the second cover spray, properly timed, will be found beneficial. When used for this purpose on Newtown apples, the "light" oil should be used. "Medium" or "light-medium" oil causes calyx injury of Newtown and other susceptible varieties of apples. Recent findings indicate that in the case of smooth leaved apple varieties such as the Newtown at least 70 per cent of the eggs of the codling moth are deposited on the lower leaf surfaces. Where oil sprays are applied for egg destruction, special attention should be given to lower leaf surface coverage.

Oil may be used with lead arsenate as a spreader-sticker only. For this purpose it should be used at the rate of 1 quart to 100 gallons of lead arsenate spray. It should be prepared in the spray tank as follows: Run water into the tank until the agitator shaft is covered. Then add the lead arsenate and follow immediately with the oil emulsion that has been diluted with an equal amount of water.

Kerosene, stove oil, and the heavier oils emulsified with soap have served as excellent deposit builders for lead arsenate. Commercial deposit builders with oil base are also available and may be used at about 1 pint to 1 quart per 100 gallons of lead arsenate spray, according to recommendations of the manufacturer. Certain neutral soaps also function in a similar manner but do not deposit quite as heavy a load of spray on the fruit. Soap treatment followed by the addition of kerosene or stove oil function likewise to deposit a heavy coat of spray. Since hard waters and spray waters of high salt content influence the preparation of these deposit builders, information and suggestions on their use should be obtained from local authorities.

Light infestations of codling moth may be controlled by a spray combination of oil and nicotine sulphate or a nicotine-bentonite mixture. Two quarts of the light-medium oil plus 1 pint of nicotine sulphate, or 3 pounds of the fixed nicotine product, to 100 gallons should be used.

3. Oil sprays for the control of spider mite

The European red mite and brown mite may be controlled effectively by oil sprays if properly timed and applied thoroughly. On apples, 3 quarts to

100 gallons (1 gallon to 100 gallons of light oil on Newtown or other susceptible varieties) is recommended. On pears, 1 gallon to 100 gallons of light-medium oil is necessary. Local authorities should be consulted on proper timing of the spider-mite spray.

OIL SPRAYS ON STONE FRUITS

The various purposes for which oil sprays are recommended in the control of insect pests of prunes, plums, and cherries may be obtained from Extension Bulletin 585. In the preparation of any of these oil sprays, precaution should be followed and the procedure of mixing in the spray tank, as described under dormant sprays, should be heeded.

'OTHER USES FOR OIL SPRAYS

Oil spray as a sticker and spreader

Oil emulsions have their place both as a spreader and as an adhesive for homemade bordeaux mixture, various commercial copper compounds, rotenone root, and pyrethrin sprays. As a sticker for bordeaux mixture the combination may be mixed in the spray tank as follows: Prepare the homemade bordeaux mixture in the usual manner as described in Experiment Station Bulletin 393. Just before beginning to spray, stir an equal amount of water in 1 quart of oil emulsion and pour into the tank. If the bordeaux mixture is applied in the dormant season, any dormant oil emulsion may be used. If the bordeaux is used as a foliage spray in summer, a light or light-medium oil having a sulphonation test of 70 or above may be used.

The combination of oil with various commercial copper compounds serves as both a sticker-spreader and safener. A pint of the oil emulsion is sufficient if 4 pounds or less are used. If 5 to 8 pounds to 100 of copper compounds are used, a quart of the oil emulsion is necessary. The mixture should be made as follows: Place the required amount of the copper compound in a bucket and add sufficient water to make a thin slurry. Then stir in the oil emulsion and add the mixture to the spray tank filled with water. Apply immediately.

Oil in bordeaux mixture reduces injury on walnut leaves

The standard recommendation for walnut blight in Oregon is a 6-2-100 bordeaux mixture. (See Extension Circular No. 382.) Under certain climatic conditions the bordeaux causes spray burn of the immature walnut leaves. This burn may be reduced appreciably, if not prevented entirely, by the addition of 1 pint of oil emulsion to each 100 gallons of the bordeaux spray. Either dormant or summer oil emulsion may be used for this purpose.

Oil sprays for ornamentals

Oil sprays are recommended for the control of holly and juniper scale, red spiders on ornamentals, cypress tip moth and spider mite during the season of their infestation. From 2 to 3 per cent light-medium or medium oil summer emulsion may be used for the purpose. The usual precautions outlined above under spray types should be followed in the preparation of the various emulsions for application. Proper agitation in the spray tank is important. This is often overlooked with the wheelbarrow type of spray outfit or other small rigs. *The emulsive oil sprays should never be used in spray equipment where agitation is faulty.*