# Directions for Preparation and Use of Insecticides and Fungicides

The following formulae for the preparation and use of insecticides and fungicides are in accordance with the best practice. This calendar has been prepared exclusively for the fruit and truck growers of the Rogue River Valley; and, with this fact in view, only such matter is included as is thought necessary for the intelligent use of insectides and fungicides in the control of such insect pests and fungous diseases as are of economic importance in the valley. For this reason, the treatment of such diseases as the Brown Rot of stone fruits, the various leaf spot diseases, the Bitter Rot of apples, etc., is omitted. Pear and apple scab, so serious in many sections, is of no economic importance in the Rogue River Valley. Only in some of the higher mountain valleys, where air drainage is insufficient, is scab found at all, and even there commercial varieties are rarely seriously attacked.

## BORDEAUX MIXTURE

This is the standard fall spray for apples and stone fruits.

| | |
|---|---|
| Bluestone (copper sulphate) | 5 pounds |
| Lime (unslaked) | 5 pounds |
| Water | 50 gallons |

Dissolve the bluestone by suspending it in a sack in water, and dilute to 25 gallons. Slake the lime to an even paste and add water to make 25 gallons. Mix these dilute solutions by pouring together slowly into the spray tank or barrel. Strain through a 20-mesh strainer made of brass wire while pouring into the spray tank. In large operations it is best to prepare stock solutions of both bluestone and lime. The bluestone may be dissolved at the rate of one pound per gallon of water. The lime may also be slaked, but not too far in advance of the time necessary to use it. By having a sufficient number of barrels for stock solutions, one man can easily keep three or four power spray outfits supplied with the Bordeaux mixture. An elevated platform upon which the mixing may be done will save a great deal of time. As little hand labor as possible should be the rule, and all that should be necessary in a well appointed mixing plant should be simply opening and closing valves or gates. A scale to weigh the materials used should be a necessary part of the equipment.

## RESIN-BORDEAUX MIXTURE

This is the standard spray for blackberries, raspberries, and other cane fruits.

| | |
|---|---|
| Resin | 1 pound |
| Sal soda crystals | ½ pound |
| Water | ½ gallon |

Boil together until a clear brown color appears; then add the above to each 50 gallons of Bordeaux mixture made according to the 5-5-50 formula, given above. The reason for using the resin mixture is to cause the Bordeaux to spread and adhere better. The Resin-Bordeaux should be applied with a good spray pump and a nozzle giving a very fine mist spray. Keep the mixture well agitated, and before using remember that it should be carefully strained so as to keep out all material which would tend to clog the nozzle.

## LIME-SULPHUR

This is the standard spray used during the spring for all fruit trees, vines, shrubs, etc., before the buds open. Lime-sulphur in concentrated form may be purchased, but there are many who prefer to boil their own solution. The proportions of lime, sulphur and water, according to the most recent investigations are:

| | |
|---|---|
| Lime (unslaked) | 1 pound |
| Sulphur (flour or flowers) | 2.2 pounds |
| Water | 1 gallon |

In order to make 50 gallons of lime-sulphur at one time, all that is necessary to do is to multiply the above formula by 50. The formula will read:

| | |
|---|---|
| Lime (unslaked | 50 pounds |
| Sulphur (flour or flowers) | 110 pounds |
| Water | 50 to 55 gallons total product when boiled |

Put about 10 gallons of water in the kettle or boiler and start the fire. Place the lime in the kettle, and, after slaking has well started, add the dry sulphur and mix it thoroughly, adding water enough to maintain a thin paste. Sift the sulphur so that there will be no lumps. After the slaking and mixing are completed, add water to about 50 gallons on the measuring stick or to a mark on the side of the boiler, and boil, stirring until the sulphury scum disappears. Then add water to about the height of 60 gallons and boil down to about 55 gallons if the spray is to be used at once. If it is desired to keep it for a short while, it may be boiled down to 50 gallons. During the boiling process the mixture should be well stirred. As a rule, 60 minutes of vigorous boiling will cause the sulphur to unite completely with the lime. A slow fire will necessarily take longer. Do not overboil; when the sulphur has combined with the lime and the mixture is to be applied at once, continued boiling only adds expense and does not help or benefit the spray. Properly made lime-sulphur is an amber-colored liquid, and there should be very little sediment. After settling and cooling, the mixture should be tested with a hydrometer. The following table, which may be used for the commercial as well as the home-boiled lime-sulphur, indicates the proper dilution for the various concentrations:

**Table for Diluting Concentrated Lime-Sulphur Solutions**

| Reading of Hydrometer Degrees Beaume | Specific Gravity | Amount of dilution Number gals. water to one gal. lime-sulphur solution. For dormant spraying. |
|---|---|---|
| 40 | 1.357 | 1 gal. lime-sulphur 11.0 gals. water |
| 39 | 1.345 | 1 gal. lime-sulphur 10.5 gals. water |
| 38 | 1.333 | 1 gal. lime-sulphur 10.1 gals. water |
| 37 | 1.322 | 1 gal. lime-sulphur 9.7 gals. water |
| 36 | 1.310 | 1 gal. lime-sulphur 9.3 gals. water |
| 35 | 1.299 | 1 gal. lime-sulphur 9.0 gals. water |
| 34 | 1.288 | 1 gal. lime-sulphur 8.6 gals. water |
| 33 | 1.277 | 1 gal. lime-sulphur 8.2 gals. water |
| 32 | 1.267 | 1 gal. lime-sulphur 7.9 gals. water |
| 31 | 1.256 | 1 gal. lime-sulphur 7.5 gals. water |
| 30 | 1.246 | 1 gal. lime-sulphur 7.2 gals. water |
| 29 | 1.236 | 1 gal. lime-sulphur 6.9 gals. water |
| 28 | 1.226 | 1 gal. lime-sulphur 6.5 gals. water |
| 27 | 1.216 | 1 gal. lime-sulphur 6.2 gals. water |
| 26 | 1.206 | 1 gal. lime-sulphur 5.9 gals. water |
| 25 | 1.197 | 1 gal. lime-sulphur 5.6 gals. water |
| 24 | 1.188 | 1 gal. lime-sulphur 5.3 gals. water |
| 23 | 1.178 | 1 gal. lime-sulphur 4.9 gals. water |
| 22 | 1.169 | 1 gal. lime-sulphur 4.6 gals. water |
| 21 | 1.160 | 1 gal. lime-sulphur 4.3 gals. water |
| 20 | 1.152 | 1 gal. lime-sulphur 4.1 gals. water |

This table is constructed for a dilution of 4.5 degrees Beaume or its equivalent 1.030 specific gravity.

**Tables Comparing Beaume's Hydrometer and Specific Gravities**

| Degrees Beaume | Specific Gravity | Degrees Beaume | Specific Gravity | Degrees Beaume | Specific Gravity |
|---|---|---|---|---|---|
| 0 | 1.000 | 14 | 1.101 | 27 | 1.216 |
| 1 | 1.007 | 15 | 1.109 | 28 | 1.226 |
| 2 | 1.013 | 16 | 1.118 | 29 | 1.236 |
| 3 | 1.020 | 17 | 1.126 | 30 | 1.246 |
| 4 | 1.027 | 18 | 1.134 | 31 | 1.256 |
| 5 | 1.034 | 19 | 1.143 | 32 | 1.267 |
| 6 | 1.041 | 20 | 1.152 | 33 | 1.277 |
| 7 | 1.048 | 21 | 1.160 | 34 | 1.288 |
| 8 | 1.056 | 22 | 1.169 | 35 | 1.299 |
| 9 | 1.063 | 23 | 1.178 | 36 | 1.310 |
| 10 | 1.070 | 24 | 1.188 | 37 | 1.322 |
| 11 | 1.078 | 25 | 1.197 | 38 | 1.333 |
| 12 | 1.086 | 26 | 1.206 | 39 | 1.345 |
| 13 | 1.094 | | | 40 | 1.357 |

**Rules for Determining Number of Dilutions and Density of Spray.**

If the density of the commercial solution or the home-made wash has been first determined by the use of a hydrometer, sprays of any desired density may be calculated by using the above table. Hydrometers do not detect impurities in lime-sulphur solutions; these can be determined only by chemical analyses. The rule for obtaining the number of dilutions is as follows: Divide the decimal of the concentrate by the decimal of the spray desired, the quotient will be the number of dilutions. Example: The concentrated lime-sulphur solution tests 34 degrees Beaume which by the table is 1.288 specific gravity. It is desired to use the lime-sulphur solution to spray upon trees at 3 degrees Beaume which is 1.020 specific gravity. The decimal of the concentrate is .288 which divided by .020 equals 14.4 which is the number of dilutions required, and which, of course, is obtained by adding 13.4 volumes of water to one volume of the concentrated lime-sulphur solution. This rule is based upon the general fact that the density of a solution heavier than water varies inversely with the number of dilutions. Another example: Supposing the decimal of the concentrate is known and this concentrate is diluted by a certain number of volumes of water, what is the decimal of the spray? Let us take the figures in the example above. The decimal of the concentrate is .288 and 13.4 volumes of water are added to it. 13.4 plus 1 equals the number of dilutions. .288 divided by 14.4 equals .020 which is the decimal of the spray and corresponds to 3 degrees Beaume.

## SELF-BOILED LIME-SULPHUR

This is the standard summer spray for peaches and other stone fruits to prevent the fruit spot disease. Its use, however, is never necessary if proper fall spraying with Bordeaux has been done. This spray is much safer than dilute lime-sulphur solutions, as it will not injure foliage. It may be used to prevent apple and pear scab where this disease appears. It also has a beneficial effect in a limited way in the control of scale. Infestation of the fruit may be checked by its use.

| | |
|---|---|
| Lime (unslaked) | 8 pounds |
| Sulphur (flour or flowers) | 8 pounds |
| Water | 50 gallons |

The lime should be placed in a barrel and enough water poured on to almost cover it. As soon as the lime begins to slake, the sulphur should be added after sifting it so as to break the lumps. The mixture should be stirred and more water added as needed to form a thick paste at first and then gradually a thin paste. The heat of the slaking lime will cook the mixture and from 5 to 15 minutes will be necessary, according to the quickness of the lime. Be sure not to let it overcook as this would tend to form compounds which would burn. As soon as the sulphur and lime have reached the paste state, fill up the barrel to 50 gallons with cold water. Do not use any hot water in making this mixture. For large operations, proportionate amounts of lime and sulphur should be used, and it will be found that it is easier to make large quantities than small amounts.

## THE IRON SULPHIDE SPRAY

This is the standard spray for apple and rose mildew for this district. The following formula is for summer use, or after the buds have opened.

| | |
|---|---|
| Iron sulphate (copperas) | 1 pound |
| Lime-sulphur (32 degrees Beaume test) | 1 quart |
| Water | 10 gallons |

Dissolve the iron sulphate in about 5 gallons of water and add the quart of lime-sulphur, stirring well. Let the black precipitate settle for a few hours and pour off the liquid, keeping the precipitate. Then add 5 gallons of water, stir thoroughly and let settle again. Pour off the liquid as before. This process is called washing, and is necessary in order to get rid of the excess lime-sulphur which would burn tender foliage. Repeat the washing until the water is no longer yellow. The black "muck" should be diluted to 10 gallons and sprayed with good agitation. If plant lice are present, tobacco extract or kerosene emulsion may be mixed with it. Arsenate of lead for the codling moth may also be applied in the same mixture without any injurious effect. For making up large quantities, proportionate amounts of the materials should be used.

It is often necessary to apply the iron sulphide before the buds open, and in this case, washing is not necessary. The best way to apply it in the case of apple mildew is with the spring lime-sulphur spray. For appies badly mildewed the previous year, use the following formula:

| | |
|---|---|
| Iron sulphate (copperas) | 15 pounds |
| Lime-sulphur (32 degrees Beaume test) | 15 quarts |
| Water | 100 gallons |

Partly fill a 100 gallon tank and add the regular amount of lime-sulphur solution for the spring spray, and to this add 15 quarts more of commercial lime-sulphur solution. Then add 15 pounds of dissolved iron sulphate and fill up to 100 gallons, stirring the mixture thoroughly, then spray with good agitation. If the lime-sulphur tests less than 32 degrees, add a little more; if over 32 degrees, a little less.

Considering the fact that for each degree Beaume there is about three fourths of one per cent combined sulphur present, it will be easy to calculate the exact amount of any concentrated lime-sulphur solution which must be added, if the test is known.

## DISTILLATE-OIL EMULSION

This is the standard spray for thrips.

| | |
|---|---|
| Water | 6 gallons |
| Lye (98 per cent) | 2 pounds |
| Fish oil | 1½ gallons |

Put water in boiler and add lye. When dissolved and the water boiling, pour in fish oil, and boil for two hours. When soap has boiled sufficiently it should have a ropy effect when stirred. This formula gives about 40 pounds of moderately firm soap.

The distilliate-oil stock emulsion should be made as follows:

| | |
|---|---|
| Hot water | 12 gallons |
| Fish-oil or whale-oil soap (above formula) | 30 pounds |
| Distillate-oil (raw) 30 to 34 degrees Beaume | 20 gallons |

Have the water boiling when put into the spray tank and add soap while agitator is running at good speed. When soap is thoroughly dissolved, pour in the distillate-oil slowly, keeping the mixture well agitated. When oil and soap are well mixed, pump out through the spray nozzle at a pressure of not less than 175 pounds into a storage tank. This is the stock emulsion, and contains 55 per cent oil. To make a 3 percent emulsion use 5½ gallons of this stock in each 100 gallon tank. To dilute, first put the stock emulsion in spray tank and then add water, keeping agitator running. To make the spray more effective, tobacco black leaf or sulphate of nicotine may be added after the emulsion has been diluted. The amount of each to add will be in accordance with the formulae given elsewhere.

## KEROSENE EMULSION

| | |
|---|---|
| Kerosene | 2 gallons |
| Hard soap (whale-oil soap) | ½ pound |
| Water | 1 gallon |

Dissolve soap in water by boiling; add hot suds to the kerosene. Do not do this near a fire. Agitate the mixture with a spray pump so as to emulsify the oil. After five minutes the mixture becomes creamy. To use, dilute the above stock solution at the rate of one gallon to 10 gallons of water. This is a standard remedy for destroying green aphis, woolly aphis, mealy bugs and other plant lice. It may be used instead of the tobacco solutions, if desired.

## WHALE-OIL SOAP AND QUASSIA

| | |
|---|---|
| Whale-oil soap | 10 pounds |
| Quassia | 5 pounds |
| Water | 100 gallons |

Place the quassia chips in a sack, cover with about 10 gallons of water and soak for 24 hours. Then boil, remove the chips, add the soap and boil until dissolved. Add water to make 100 gallons. For making whale-oil soap see formula given elsewhere. This formula has given good success in destroying soft bodied insects like plant lice, young squash bugs, etc.

## ARSENATE OF LEAD

| | |
|---|---|
| Arsenate of lead | 4 pounds |
| Water | 100 gallons |

It is better to purchase arsenate of lead than to attempt to make it. In mixing, preparatory to spraying, the amount of arsenate of lead for each spray tank full should be worked into a very thin paste having the appearance of milk of lime. It should never be thrown as a mass into the spray tank. This is the standard spray for codling moth and other eating insects.

## TOBACCO SPRAYS

(1)

| | |
|---|---|
| Tobacco black leaf | 1 gallon |
| Water | 65 gallons |

(2)

| | |
|---|---|
| Sulphate of nicotine (black leaf 40) | 1 pint |
| Water | 112 to 125 gallons |

This is the standard summer spray for sucking insects, such as green aphis, woolly aphis and other aphides.

## HELLEBORE

| | |
|---|---|
| Hellebore | 1 ounce |
| Water | 2 gallons |

This is valuable as an insectide for use on vegetables which are almost ready for market and on which arsenicals cannot be used.

## PYRETHRUM

| | |
|---|---|
| Pyrethrum | 1 ounce |
| Water | 2 gallons |

This is a contact insecticide but is not poisonous to man. Burning a little pyrethrum powder in a room will tend to destroy flies and mosquitoes. It may be dusted on plants as a dry powder.

## CARBOLATED LIME

This may be used for root maggots. Work the mixture into the soil.

| | |
|---|---|
| Lime (unslacked) | 10 pounds |
| Carbolic acid (crude) | 1 to 2 pints |
| Water | 50 gallons |

Slake the lime with a little water, add the rest of the water and the carbolic acid.

## CARBOLIC ACID EMULSION

This, like the above formula, may be used to destroy eggs and young maggots infesting onions, radishes and other garden crops.

| | |
|---|---|
| Carbolic acid (crude) | 1 pint |
| Soap (hard) | 1 pound |
| Water | 1 gallon |

Dissolve soap in boiling water; add acid and stir or churn, as in making kerosene emulsion, until the substance becomes creamy. To use, dilute one part of the emulsion by adding 30 parts of water.

## BRAN-ARSENIC MASH

| | |
|---|---|
| White arsenic | 1 pound |
| Brown sugar (or molasses) | 1 to 2 pounds |
| Bran | 6 pounds |

Thoroughly mix the above and add enough water to make thoroughly wet. A spoonful should be placed near the crown of each tree. The mash may be used to kill grasshoppers, but it is usually best to cover the trees and use the Bordeaux mixture as a repellent.

## BRAN-PARIS GREEN MASH

| | |
|---|---|
| Paris Green | 1 pound |
| Bran | 40 pounds |
| Molasses or sugar | 1 to 2 pounds |
| Salt | ½ pound |

Make a mash by adding water; add molasses (or sugar) and salt; mix thoroughly and scatter in small piles among plants or in beds before planting. This bait will prove more or less effective in killing cut worms and cabbage worms. It may be sown among the rows of plants to be protected. It is valuable for destroying cut worms in young onions.

## FORMALIN

**(Formaldahyde)**

| | |
|---|---|
| Formalin (40 percent solution) | 1 pint |
| Water | 30 gallons |

This is a preventive of potato scab and smut of grains. Potatoes and grains should be soaked in it for about two hours. Smut of onions may also be prevented by treating the seed. Practically all garden seeds will be disinfected by the use of this formula.

## CORROSIVE SUBLIMATE

**(Bichloride of Mercury)**

This is the standard disinfectant when working with PEAR BLIGHT. No other disinfectant should be used to wash the cut surfaces or to disinfect the pruning tools.

| | |
|---|---|
| Corrosive sublimate | 1 part |
| Water | 1000 parts |

Corrosive sublimate may be purchased in tablet form at drug stores, and directions for making solutions will be found on the container. Never put corrosive sublimate into a metallic container, always use a glass bottle. Be sure to label the bottle "POISON" in large, plain letters. It is the deadliest of poisons.

## PINE TAR

For soil-infesting, seed-eating insects such as the wire worm, tar may be used with good results.

| | |
|---|---|
| Pine tar | 1 teaspoonful |
| Seeds | 15 pounds |

Dampen the seeds, such as corn, squash, canteloupes, etc., with a little warm water. Put in the tar and mix thoroughly; allow to dry before planting. The tar acts as a repellant.

## STICKY PREPARATIONS

**(Tanglefoot)**

Tanglefoot may be purchased in cans or pails. It is manufactured by O. and W. Thum Co., Grand Rapids, Michigan. By putting it on bands of paper or strawboard secured about the trunks of trees, it will catch such insects as creep up or down the trunks of trees. It will not dry readily, and one application will last a long time.

## WHITEWASHES

(1)

**Government Whitewash**

| | |
|---|---|
| Lime (unslaked) | 40 pounds |
| Salt | 15 pounds |
| Rice flour (or ground rice) | 3 pounds |
| Spanish whiting | ½ pound |
| Glue | 1 pound |
| Water | 5 gallons |

Slake the lime in warm water and cover so as to keep in the steam; strain through a fine sieve or strainer; add the salt, well dissolved, in warm water. Then add the rice boiled hot; the Spanish whiting, and finally the glue which has been previously dissolved over a slow fire. Lastly, add the five gallons of hot water. Stir well and let stand for a few days. Apply hot with a brush. One pint of the mixture will cover a square yard. Coloring matter may be put in, such as Spanish brown, yellow ochre, etc.

(2)

**Whitewash for Trees**

| | |
|---|---|
| Lime (air slaked) | 30 pounds |
| Tallow | 4 pounds |
| Salt | 5 pounds |
| Water | Enough to make wash flow well. |

When old trees are cut back for top working, they may be protected from sun scald by using the above wash.

## WHITE LEAD PAINT

White lead, slightly thinned with linseed oil, should be used where large cuts are made, or in case where the wood is exposed by the removal of the bark and cambium as in the case of pear blight eradication. It should not be applied in the latter case until it is certain that the disease has been eradicated.

## GRAFTING WAX

| (1) | (2) | (3) |
|---|---|---|
| Resin ....4 pounds | 3 pounds | 4 pounds |
| Beeswax ...2 pounds | 2 pounds | 2 pounds |
| Tallow ....1 pound | 2 pounds | Linseed oil 1 pint |

## GRAFTING WAX FOR WALNUTS

| (1) | (2) |
|---|---|
| Beeswax .....1 pound | Beeswax .....1 pound |
| Resin .....5 pounds | Resin .....5 pounds |
| Linseed oil ....1 pint | Linseed oil ....1 pint |
| Lamp black ....1 ounce | Flour .....1 pint |