

CIRCULAR OF INFORMATION NO. 10

UNIVERSITY OF THE STATE OF MISSOURI
COLLEGE OF AGRICULTURE AND MECHANIC ARTS

AGRICULTURAL EXPERIMENT
STATION

SPRAY CALENDAR

COLUMBIA, MISSOURI, MARCH 15, 1902

Columbia, Mo.:
Press of E. W. Stephens
1902



SPRAYING

BY N. O. BOOTH, ASSISTANT IN HORTICULTURE.

Spraying has come to be such a routine part of fruit growing that no apology is needed for the issuing of another spray calendar. This circular does not embody the results of any particular experiments, although it has been changed materially, as a result of the experience of the seven years which have elapsed since we last issued a Bulletin on the subject, and as a result of the accumulated experience of the country during that period.

There has been considerable improvement in spraying machinery of late years. The manufacturers have shown considerable enterprise in trying to discover and supply the fruit-growers needs. Every man who has occasion to spray should keep a collection of the different spraying catalogues on hand, as many of them are small compendiums, giving concise directions for spraying and formulas for the standard spray mixtures.

There is no part of fruit growing that is so apt to be neglected as spraying. The busy season of the year at which it must be done and the fact that the results do not show immediately, are probably responsible for this neglect. And yet if good results are expected, there is nothing more imperative than thorough work. It is especially important to do the first spraying in the spring thoroughly. At this time the plants should be sprayed with a fine mist until they drip. The opportunity to reach all parts of a tree are never so good after the leaves appear.

The success of these operations will depend largely upon the selection of a proper spray pump. Whether the pump be merely one which is to be used in a bucket, or whether it be part of a horse power, automatically geared tank sprayer,

it should be of the very best quality. The best in this case is always the cheapest in the long run. Spray pumps have not been reduced materially in price since they were first introduced, but they have been greatly improved in quality. Every buyer should insist upon purchasing a good force pump with all the parts brass which come in contact with the liquid.

THE EFFICACY OF SPRAYING

Spraying for insect pests and fungous diseases gives widely varying results. For black rot of the grape, for example, it is almost if not quite a complete preventive, and apple scab can be reduced so that the damage is comparatively trifling. Bitter rot, however, frequently requires more persistent and careful spraying and even then is not held so well in check. Insects vary as much as fungi in their ability to withstand spray mixtures. Some persons expect far too much from spraying. They think, if they spray for a certain disease and find the least trace of that disease, no matter how slight, that the spraying has been a failure. *Spraying is a preventive, not a cure. Once a disease like rot or scab has gained entrance into a fruit it is beyond the reach of spray mixtures. Therefore, a person should not wait until his whole plantation is affected before commencing to spray.*

Within the last year or two the attention of the fruit growers of this State has been attracted to machines for the distribution of fungicides and insecticides in the form of a dry powder. When machines of this character have been perfected, to the large growers especially, they will possess merits over the liquid appliances, but it is not probable that they will ever supplant the liquid pumps for use in small orchards. In the large orchards of the State, it is not practicable to do all of the spraying at the proper time when liquid is used, that is, with a reasonable expenditure for apparatus and help. Moreover, in many places in the Ozarks it is not convenient to secure the necessary water. The largest orchard company in the State uses the dust process and the manager says of it:

“We have to use the dust in order to get over our orchards, but I do not believe it is as effective as liquid.” Dust “spraying” may be said to be still in the experimental stage. It has been demonstrated beyond a reasonable doubt that the danger of poisoning to man or beast in spraying with the standard liquid solution, is practically nothing. This point has not been determined however, in the case of the dust mixtures. On potatoes and certain low-growing garden vegetables, however, insecticides in the form of dust have been applied for years with success. We are now testing some of these machines, and hope to give some more definite data on this point in the course of another year.

MISSOURI AGRICULTURAL EXPERIMENT STATION.

SPRAY CALENDAR, MARCH, 1902.

	Plant.	First Application.	Second Application.	Third Application.	Fourth Application.	Fifth Application.	Remarks.
	APPLE.—Scab, bitter rot, biting insects, twig blight.	Before buds begin to swell in spring, copper sulphate solution.	Just before flowers open, Bordeaux mixture.	As last flowers are falling, Bordeaux mixture, and arsenites.	8 to 10 days later, Bordeaux and arsenites.	8 to 12 days later, Bordeaux and arsenites.	For codling moth repeat in 8 or 10 days. If bitter rot appears, continue Bordeaux every 10 or 14 days until fruit is picked. Cut out and burn all blighted twigs.
CABBAGE.	Worms.	Arsenites when worms appear.	Repeat if necessary.	Repeat if necessary.			
	Harlequin bug.	When the insects appear on the catch or trap crop, kerosene.	(Do not spray cabbage with kerosene at any time.)				Sow catch rows of mustard or radishes and spray with pure kerosene when the insects get on them.
	Lice.	When insects appear, with quassia and tobacco solution.	Repeat if necessary.	Repeat if necessary.	Repeat if necessary.		
	CURRENT, GOOSEBERRY.—Mildew, worms, aphids.	When leaves appear, potassium sulphide solution.	10 days later, potassium sulphide solution. Hellebore for worms; quassia and tobacco for aphids.	Repeat second when necessary.			
	EVERGREENS.—Bag worms.	When bag worms first appear, arsenites (1 lb. to 100 gal. water).	Repeat first if necessary.	If worms persist until wood is ripe and weather dry add more arsenites.			Pick bags containing eggs in winter. To tell when worms hatch, hang bags containing eggs in bottle in conspicuous place with bits of colored cloth.

MISSOURI AGRICULTURAL EXPERIMENT STATION. SPRAY CALENDAR, MARCH, 1902—Continued.

Plant.	First Application.	Second Application.	Third Application.	Fourth Application.	Fifth Application.	Remarks.
GRAPE.—Black rot, biting insects.	Before buds swell in spring, copper sulphate solution.	Before flowers open, Bordeaux and arsenites.	When flowers have fallen, repeat second.	10 to 14 days later, Bordeaux and arsenites.	If rot appears after fruit is half grown, ammoniacal copper carbonate solution.	Sacking bunches in paper bags is profitable in small plantings for home use. Sack when berries are first formed.
NURSERY STOCK.—Fungous diseases, biting insects.	Before buds open in spring, copper sulphate solution.	When leaves appear, Bordeaux and arsenites.	14 days later, repeat second.	14 days later repeat second.	Repeat second in 14 days.	Cut out and burn fire blight if it appears.
PEACH, NECTARINE, APRICOT.—Brown rot, leaf curl.	Before buds begin to swell, copper sulphate solution.	Just before flowers open, Bordeaux.	When flowers have fallen, dilute Bordeaux, using only 2 lbs. of blue vitriol.	10 days later repeat third.	Ammoniacal copper carbonate every 10 days for rot after peaches are nearly grown.	Spray with Bordeaux in late winter for leaf curl.
PEAR.—See Apple.						
PLUM.—Brown rot, curculio.	Before buds open in spring, copper sulphate solution.	Just before flowers open, Bordeaux.	When flowers have fallen, dilute Bordeaux, using only 2 lbs. of blue vitriol.	10 to 14 days later, repeat third.	12 to 15 days later, repeat third.	Jar trees for curculio morning and evening after fruit sets. Am. copper carb. solu. every week from time fruit reaches full size until gathered.
POTATO.—Scab, blight, beetles.	Soak seed for scab in corrosive sublimate solution.	When beetles appear, arsenites.	When plants are one-half grown, Bordeaux. Arsenites for beetles.	10 to 14 days later, repeat third.	10 to 14 days later, repeat third.	
QUINCE.—Fungous diseases, biting insects.	Before buds open in spring, copper sulphate solution.	When fruit has set, Bordeaux and arsenites.	Two weeks later, Bordeaux.	Two weeks later, repeat third.	Two weeks later, repeat third.	If rot appears at time of ripening, spray with am. copper carb. sol. Clean up and destroy all decayed fruit.

MISSOURI AGRICULTURAL EXPERIMENT STATION. SPRAY CALENDAR, MARCH, 1902—Continued.

Plant.	First Application.	Second Application.	Third Application.	Fourth Application.	Fifth Application.	Remarks.
RASPBERRY, BLACKBERRY, DEWBERRY.— Anthracnose.	Before buds open, copper sulphate solution.	When leaves are opening, Bor- deaux. Cut out all rusted canes that appear.	Two weeks later (when not in flow- er) repeat second.	Before fruit is full size, ammoniacal copper carbonate solution.	After fruiting, Bordeaux.	If anthracnose appears, cut out all old wood as soon as fruit is gathered, and prune more severely than usual in late winter or early spring.
ROSE.—Mildew, slugs.	When leaves appear, ammoniacal copper carbonate solution.	If slugs appear, Hellebore.	If fungi appear, repeat first. For slugs, repeat sec- ond.			Indoor roses may be treated with kerosene emulsion (very dilute), for aphids. Tobacco smoke may be used for the same purpose.
STRAWBERRY.— Rust.	Just before the first flowers begin to open, Bordeaux.	When first fruit sets, repeat first.	Before fruit ripens, ammoni- cal copper car- bonate.	When last fruit is harvested, Bor- deaux.	Repeat fourth if necessary.	Young plants not in bearing may be treated throughout the season.
TOMATO.—Rot, blight.	At first appearance of fungus disease, Bor- deaux.	Repeat first every two weeks if nec- essary.				

Do not spray when plants are in bloom.

For aphids (plant lice) use kerosene emulsion or quassia and tobacco.

Use 20 per cent kerosene for scale insects in winter, and in summer when young scales are hatching use 10 per cent.

Fruit discolored with Bordeaux mixture is not at all poisonous.

FUNGICIDES

BORDEAUX MIXTURE.

Copper sulphate (Blue Vitriol).....	4 pounds
Fresh Lime (unslaked)	4 pounds
Water	50 gallons

Dissolve the copper sulphate by hanging an open sack containing the sulphate in a tub of water, so the bottom of the sack is just below the surface of the water. Slake the lime carefully, not allowing it to burn. Pour dissolved copper sulphate into spray barrel (or tank) and add water to bring the quantity to twenty gallons. Add slaked lime and put in water to bring whole quantity to fifty gallons. If arsenites be used, as they usually are, put them in at the same time as the lime.

AMMONIACAL COPPER CARBONATE.

Copper carbonate.....	6 ounces
Strong ammonia (26 degrees strength). Just enough to dissolve the copper carbonate, about....	3 pints
Water to make.....	50 gallons

First make a thin paste of the copper carbonate with water, then add the ammonia, stirring constantly, until the copper carbonate is all dissolved. Dilute with water to fifty gallons. This mixture does not discolor fruit and hence can be used up to ripening period.

COPPER SULPHATE SOLUTION.

(Used only when leaves are off.)

Copper sulphate.....	3 to 5 pounds
Water	40—50 gallons

POTASSIUM SULPHIDE SOLUTION.

Potassium sulphite (Liver of Sulphur).....	1½ pounds
Water	50 gallons

Dissolve the Potassium Sulphide in the water.

CORROSIVE SUBLIMATE SOLUTION.

(For Potato Scab.)

Boil two ounces of corrosive sublimate in two gallons of water, until thoroughly dissolved. Add water until the whole equals sixteen gallons. Soak the uncut potatoes in this solution for one and one-half hours, before planting. The land on which potatoes are planted must also be free from scab and should not have been freshly manured.

INSECTICIDES

FOR INSECTS WHICH EAT. (BITING INSECTS.)

All of the poisons here given for this class of insects except hellebore, are known as *arsenites*, that is they contain arsenic, (arsenous acids) on which their poisonous character depends. These may be used alone or they may be used with Bordeaux mixture, treating the Bordeaux mixture as so much water.

Paris Green or London Purple.....	1 pound
Lime (unslaked).....	3 pounds
Water	125—175 gallons

Make the arsenite into a smooth paste with a little water before putting into the spraying tank. Slake the lime and pour it into the tank. If the arsenite be added dry, it is apt to float on top and not become mixed thoroughly with the liquid. Paris Green and London Purple are only of advantage on account of their ease of preparation, and for safety and efficacy we strongly advise the use of one of the two following in their stead. Both the arsenate of soda, and the arsenate of lead, are coming into general use as substitutes for Paris Green and London Purple. They are not adulterated, are cheaper, not so liable to settle to the bottom of the tank in spraying, and the danger of burning the foliage is less.

ARSENATE OF SODA.

White arsenic (powdered).....	2 pounds
Sal soda.....	8 pounds
Water	2 gallons

Boil all together for fifteen minutes or longer if necessary to thoroughly dissolve the arsenic. Use one quart of this stock solution and four pounds of lime to each fifty gallons of water.

ARSENATE OF LEAD.

Arsenate of soda.....	4 ounces
Acetate of lead.....	11 ounces
Water	50—75 gallons

Dissolve separately in water and then mix and allow the mixture to stand over night. Add 50 to 75 gallons of water.

The arsenate of soda is somewhat cheaper than the arsenate of lead, and the ingredients can be secured in any drug store, but the arsenate of lead can be used in greater strength without danger of burning the foliage. Susceptibility of foliage to being burned is largely a matter of season and locality, consequently it is well to use the weaker arsenical solutions first, only using the stronger when it is necessary. When spraying is done frequently it will be found that the arsenates are apt to gather on the foliage and burn, hence the amounts must be lessened in the later applications. There is considerable difference in the ability of different plants to withstand spray mixtures. With the cabbage, pear, apple, potato, etc., there is but little danger of burning the foliage, while the peach, plum, bean, rose, etc., are very easily scorched. Insects generally are easier killed when young, hence it is advisable to spray early when insects first appear.

HELLEBORE.

<i>Fresh</i> white hellebore.....	2 ounces
Water	3 gallons

Apply when thoroughly mixed. Hellebore is used when it is not advisable to use arsenates on account of the tender foliage or the proximity of the ripening period.

FOR SUCKING INSECTS

KEROSENE.

Kerosene (coal oil) is probably the best remedy we have for scale or plant lice insects generally. It is comparatively cheap and can be procured everywhere. It should be used as a kerosene emulsion, and should be applied as a mechanical mixture with one of the mechanical mixture pumps. The twenty per cent. solution of kerosene should be applied for scales early in spring before the buds burst and the ten per cent. mixture may be used during the summer. None of these should be applied in early winter.

KEROSENE EMULSION.

Hard soap	½ pound
Boiling water	1 gallon
Kerosene	2 gallons

Dissolve the soap in the water, and while hot add the kerosene and mix by pumping back into the mixing tub for ten minutes. Dilute with nineteen gallons of water before use. During the last few years pumps have been introduced in which kerosene and water are placed in separate compartments of the spraying machine and are mechanically mixed by the pump in proportions which may be varied by the operator. Any one who has by practical experience learned the labor of making kerosene emulsion, welcomes this timely device.

QUASSIA AND TOBACCO SOLUTIONS.

Quassia chips	3 ounces
Tobacco stems	½ pound
Water	3 gallons

Soak the quassia chips and tobacco each in a separate bucket containing one gallon of water over night. Next morning boil the quassia, tobacco and water in which they have been soaked, for fifteen minutes. Pour the two solutions together and add water to make three gallons.

It must be borne in mind that spraying is merely an adjunct to cultivation and sanitary measures, as a means of producing healthy, profitable plants. The fact that one sprays should not deter one from burning trash where insects might harbor, or from burying fungus infested fruit. A healthy, strong growing plant is not nearly so apt to be attacked by diseases as a weak growing one.