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SPRAY PUMPS AND SPRAYING.

WENDELL Paddock.

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The Bulletins published by the Station will be sent free to any farmer applying for them.

*Connected with Second Judicial Department Branch Station.
†Connected with Fertilizer Control.
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SPRAY PUMPS AND SPRAYING.

WENDELL PADDOCK.

SUMMARY.

We are constantly in receipt of inquiries concerning spraying apparatus and methods of spraying, which show that elementary instruction on this subject is still needed. The following pages were prepared to meet this want, and the bulletin is addressed to those persons who are seeking such information.

Some of the spraying machinery now on the market that has been tested at this station is illustrated and described and the addresses of the firms manufacturing it is given. The formulas of the principal mixtures used in spraying are given and many necessities and conveniences are mentioned.

IMPORTANT NOTICE.—Do not spray trees or plants when in bloom. It is in no instance necessary or desirable. By so doing not only are we liable to injure the delicate parts of the flowers but, what is more important, to poison the bees and other insects that are our friends. It would be impossible to grow some of our fruits commercially without the aid of insects in fertilizing the blossoms.

INTRODUCTION.

Since spraying has become one of the operations of culture with so many farmers and fruit growers it would seem as if explicit directions were now almost superfluous. Numerous bulletins on the subject have been issued by our experiment stations, and the pages of agricultural and horticultural
papers are alive with discussions on the subject. However, that there are many localities in the State where the methods of spraying are not understood is revealed by the numerous letters of inquiry that are received at this Station.

In order to simplify correspondence, as well as to supply a still popular demand it was thought best to issue another bulletin on spraying machinery. Accordingly a circular letter was sent to some of the leading manufacturers requesting them to send their pumps to the Station for testing. The majority of the firms addressed responded to the request and kindly sent their pumps free of charge.

In testing pumps it is not our purpose to try to decide what one is best, as some forms are better adapted to certain kinds of work than others. In the following pages we have tried to point out the good and bad features as they have appeared to us in our tests, so that the reader who intends to buy a spraying outfit may have a clear idea of what the pumps are like before he places his order. The illustrations are for the most part quite plain so that extended descriptions need not be given.

Many of the hints on spraying that are given have been printed a number of times in former bulletins of this Station. However, we still receive numerous questions concerning these points, so a repetition of them will not be out of place here.

Selection of a pump.—When selecting a pump one should not have in view the cheapest one that will do good work. Almost any of the pumps now on the market will work satisfactorily for a time, but there are a number of other qualifications that should be considered. The durability, capacity, ease of working, ease with which the parts may be gotten at and repaired or replaced, and the efficiency of the agitator, are among the essentials that should be thought of.

Work intelligently.—We sometimes receive such questions as the following: “Isn’t it about time for me to spray my orchard?” When the questioner is asked what he intends to spray for, perhaps the answer will be, “Oh, I don’t
know, only I thought that it must be about time to begin." It is safe to say that such persons will not be able to see much benefit to be derived from spraying.

Occasionally inquiries are made concerning the use of Bordeaux mixture for poisoning insects, and the value of Paris green for combating plant diseases. It cannot be too strongly emphasized that *Bordeaux mixture is used only to prevent the spread of plant diseases*, such as apple scab, though it serves as a repellent against some insects. *Paris green is used to poison insects that chew their food*, as do the potato beetle and the canker worm. *Kerosene emulsion is used to kill insects that suck their food*, as do plant lice and scales.

This brings to mind the man who has sprayed and complains that he can see no benefit resulting from his labor. Such complaints can usually be attributed to one of two causes. Either the work was not properly done, or else insects and diseases were not present in sufficient numbers to do any appreciable amount of injury. This only helps to emphasize the fact that each person must become acquainted with these pests for himself, for in no other way can he intelligently combat them. It will not do to follow printed instructions or spray calendars too closely, for spraying cannot be done by rule, since the conditions are not the same from year to year. There are a few pests, such as the apple scab and codling moth that are universally distributed, and we may expect attacks from them each season. It will pay to spray every season for such pests. We occasionally have seasons when the weather conditions are not suitable for the spread of insects and diseases, but they are the exception. Even in such seasons the spray will have some value, as it will tend to further diminish the spread of the pests, so that they may be more readily held in check when conditions favorable to their increase do arise. Therefore we must not conclude that spraying will not pay because we do not get flattering results in any one season, for the next year may bring conditions when our plants will most need protection.

A very little reading and study will enable any one to become familiar enough with the common insects and dis-
eases to know them when he sees them and to learn how to combat them. The first thing to be done, then, is to find out what we are going to spray for, and how and when to apply the remedy. Bulletin No. 86 of this Station gives general directions for combating the principal fungous and insect pests, and other bulletins have been issued on special insects and diseases at intervals as they have demanded attention. A supply of many of these is still on hand and copies may be had for the asking.

HAND MACHINES.

PUMPS.

The Eclipse.—The style of pumps illustrated in Figures 1 and 2 is a comparatively new idea in spray pumps. Though they have but recently been introduced, a large number of them are in use, and they seem to be giving satisfaction. The Eclipse, illustrated in Figure 1, was the first of the two to be put on the market. This pump is manufactured by Morrill & Morley, Benton Harbor, Mich., and is listed at $20.00. The illustration gives a good idea of the form of the pump. All parts that come in contact with the liquid are made of brass, and as can be seen the pump is placed directly in the barrel. The cylinder is at the bottom, and is made of solid brass, there being no stuffing-box. The plunger consists of a short cylinder of brass, around the center of which is fitted a small amount of packing. The arrangement of the parts is such that the piston cannot work clear through the cylinder, consequently the cylinder wears more at the center than at either end. In one season's hard use we find that the wear becomes so great that sufficient packing cannot be gotten in to fill up the center of the cylinder. However, a worn-out cylinder can be quickly replaced at a cost of seventy-five cents.

The agitator, as is shown in the cut, consists of a wide, spoon-shaped blade or paddle, which is fastened at one
end by a hinge to the lower end of the cylinder. A rod connecting with the pump handle moves the blade up and down with every stroke. This device is quite satisfactory.

The air chamber surrounds the discharge pipe, and is of sufficient capacity to insure a steady spray.

When the cylinder or plunger needs attention the pump must be taken from the barrel, but this is not a difficult task, since the pump is removed by unscrewing two bolts that are entirely on the outside of the barrel; this is quite different from the old way of loosening four or more rusty bolts that can be reached only through a small hole in the top of the barrel.

**The Pomona.**—The Pomona pump, illustrated in Figure 2, is manufactured by the Gould Pump Company, Seneca Falls,
N. Y. It is listed at $20.00. It is much like the Eclipse in its construction, but a change has been made for the better in the plunger and cylinder. Instead of the long cylinder and short plunger, with packing on the latter, a comparatively short cylinder provided with a stuffing-box is used, while a long brass plunger passes entirely through the cylinder with each stroke of the handle. With this arrangement one part of the cylinder cannot wear more than another.

Two styles of agitators are furnished with this pump. One is worked by the pump handle as shown in the cut. The other style is illustrated in Figure 3, which explains itself. Either one does good work, but the liquid may be more thoroughly stirred by the latter.

The Caswell.—Figure 4 illustrates the Caswell pump, manufactured by the Caswell Pump Company, Sandusky, Ohio. The list price is $20.00. These pumps have been thoroughly tested and have proven to be satisfactory. One of the largest fruit growing firms in this vicinity has used the Caswell for several years and is enthusiastic in its praise. All of the parts are made of brass, and are easy of access when any repairs become necessary. Either of the two valves may be gotten at by unscrewing a cap. This fea-
ture is quite an improvement over the old way of having to take the pump out of the barrel and all to pieces before any of the working parts can be reached. The plunger has an up and down motion, but the arrangement of the handle is such that it is similar in motion to that of a horizontal pump. Thus the weight of the body may be thrown on both the for-
ward and backward strokes. The pump cannot be put on a barrel, but is bolted to the wagon frame, or to a frame made for the purpose, as is shown in the cut. The agitator is not as good as could be desired, and when a larger tank is to be used some other form must be devised.

**The Advance.**—The Advance pump, illustrated in Figure 5, is manufactured by the Deming Pump Company, Salem, Ohio. The list price is $18.00.

In appearance this pump is much like the ones that were first placed on the market. The similarity is principally in appearance, as many improvements have been made. By detaching the stuffing-box cap the plunger and the lower valve may be taken out of the cylinder. Accordingly the pump need not be taken from the barrel and nearly to pieces when any repairs become necessary. The large air chamber, together with the large cylinder, insures a steady spray. The agitator consists of two blades and a plunger that are operated by a connection with the pump handle, as shown in the cut.

The pump was received so late in the season that it was impossible to give it a thorough test. It is certainly well made and powerful, and no doubt will prove to be a satisfactory outfit.

**The Empire Queen.**—This pump is manufactured by the Field Force Pump Company, Lockport, N. Y. The list price is $9.00. This is one of the old style pumps that must needs be unbolted and taken from the barrel and pretty much to pieces when any repairs become necessary. Therefore, where
a large amount of work is to be done and repairs necessarily become more or less frequent it is likely that the improved forms will be cheaper in the end. In smaller orchards the low price might make it more economical than the more expensive pumps, since the wear would be much lighter. It does good work while in repair.

The agitator, however, is not as efficient as could be desired, as it has an easy motion and does not agitate the liquid violently as is necessary in order to do the best work.

The Geiger.—This pump is manufactured by the Geiger Pump Company, Rochester, N. Y., and is listed at $20.00. It may be classed among the novelties in spraying machinery, and as such only severe testing will determine its value. It works
on the principle of the semi-rotary pumps. All who have tried pumps of this class know that they are very satisfactory as long as the parts fit closely. There are no valves to get out of order. No leather or rubber or packing of any form to be replaced; these points are of great importance. However it has been our experience that one season's hard use wears the cylinder so that it must be replaced.

The agitator of the Gieger is made to revolve by means of gearing and a crank, and consists of a blade or paddle fastened to a piece of tubing. The suction pipe is inside the tube and takes up the liquids through sieves in the blade of the agitator. As the pump was not received early enough in the season for us to give it a thorough test we are not able to speak positively as to its merits.

The Defender.—The P. C. Lewis Manufacturing Company, Catskill, N.Y., manufactures the Defender pump, which sells for $10.00. It is made to fasten on the side of a barrel, and is light and simple in its construction, as may be seen in the illustration. All parts that come in contact with the liquids are made of brass; the valves are made of leather but they are easily replaced when worn out, as the parts may be unscrewed with the hand. It is unfortunate that the hose
couplings are of an unusual size, as the hose that is supplied with most pumps cannot be used interchangeably with this. In spite of its small size the pump is quite powerful but it taxes its capacity to supply four nozzles. Its convenient form and light weight will commend it for many kinds of work, while its low cost brings it within the reach of all.

**Bucket pumps.**—These pumps are made to fasten on a pail, and are very useful where a small amount of spraying is to be done. They are manufactured in great variety and may be obtained from most dealers at a small cost.

**Knapsack sprayers.**—These machines are small spraying outfits that are designed to be carried on the back, hence the name. There are several patterns manufactured by different firms, which differ from each other only in minor details. In general they consist of a copper tank, holding from three to five gallons, that is held in place on the back by straps over the shoulders. A small force pump is operated by one hand while the nozzle is directed by the other.

In a former bulletin these sprayers were recommended as being almost indispensable. With greater experience we find that so much hard, dirty work is involved in their use that we do not feel like recommending them except in cases where bucket and barrel pumps cannot be used to advantage.
Knapsacks may be obtained of most dealers in spraying supplies at a price ranging from $10.00 to $15.00.

POWDER GUNS.

Powder guns are used to apply poison and repellents for insects in the green-house or on small plantations of fruit or vegetables. The well-known Leggett Powder Gun may be taken as an example of these guns. It consists of a reservoir and an inclosed fan operated by a crank, which blows the powder out through a tube. It is supplied with a number of nozzles and tubes which are used in the different kinds of work. It is made principally of tin, and weighs about five pounds.

Fig. 9. The Leggett Powder Gun.

Some manufacturers assert that these guns are just the thing for poisoning bugs in large potato fields, using the clear Paris green. Most fungicides cannot be applied in a dry form, and since it is often advantageous to use both insecticides and fungicides it would seem to be better economy where a large amount of work is to be done to invest in a machine that will apply a remedy for both insects and diseases at the same time.

The Lightning Potato Bug Killer.—This little contrivance is quite convenient for applying poison and repellents for insects in the green-house or in small plantations of fruit or vegetables. It consists of a small hand bellows with a funnel-shaped spout. The material to be applied is poured into the bellows through the spout, through which it is puffed.
out in a cloud-like form. Where small amounts of tobacco dust, pyrethrum, hellebore or Paris green are to be applied this bellows will be very useful.

These implements may be obtained from dealers in florists' supplies at a small cost.

POWER SPRAYING MACHINES.

Steam sprayers.—It is likely that in the near future some form of power spraying machines will be in common use on our large fruit farms. It is only about two years ago that steam was first used in spraying, so there has not been sufficient time to fully develop this form of spraying machinery. However, several firms are now manufacturing steam spray-

![Fig. 10. Steam Sprayer.](image-url)
ing outfits, and it is probable that great improvements will soon be made.

The Rochester Machine Tool Works, Rochester, N. Y., manufacture the power spraying machine illustrated in Figure 10. The outfit consists of a one horse-power engine and boiler, a small steam pump and a spray tank. The entire outfit weighs about six hundred pounds, and may be loaded on an ordinary wagon.

The boiler burns kerosene, and will consume about three and one-half gallons in ten hours if run at full capacity. The pump is powerful, but since no air chamber is provided the spray is not as steady as could be desired.

The manufacturers appreciate the necessity of agitating the spraying mixture, and the engine is furnished for the purpose alone. It is to be hoped that some cheaper method of agitating may be devised. The manner of attaching the suction pipe to the bottom of the tank should be changed. No matter how perfect the agitation may be the particles of the mixture will settle in a pipe attached in this manner. Aside from the annoyance of clogging the nozzles, it not infrequently happens that the suction pipe becomes entirely stopped up. This cannot happen if the pipe enters the barrel from the top.

The list price of this outfit complete is $250.00.

Horse-power sprayers.—In spraying large areas of potatoes or truck crops where the machine may be kept in continuous motion, horse-power sprayers may be used to advantage. These machines may be divided into two classes, those that are provided with a pump, and those that discharge the liquid by force of gravity; of the two styles the former is much to be preferred, since the liquid is forced through fine nozzles, and is, consequently, more intelligently applied. From four to six rows may be sprayed at a time, and where the machine is provided with a pump the nozzles can usually be adjusted so that they make satisfactory sprayers for vineyards that are located on level ground. Where the vineyard is planted on uneven or hilly land it is much more satisfactory
to direct the nozzle by hand, even though a power machine is used.

Before buying, the purchaser should investigate the subject thoroughly, so as to get a machine that is suited to his particular wants. The addresses of a few of the firms who are manufacturing horse-power sprayers are given below:


The machines manufactured by these firms, except the one last mentioned, were illustrated and described in Bulletin No. 74 of this Station. Copies of the bulletin may still be had upon application.

The mycologist of this Station, who is located on Long Island, sends the following description of the Hudson Sprayer, manufactured by the Riverhead Agricultural Works:

"The Hudson Spraying Machine is designed specially for applying Bordeaux mixture to potatoes, for which work it is well adapted. It sprays four rows at each passage. The parts are so arranged that each row receives the spray from two nozzles, which can readily be adjusted to suit the size of the plants. The machine is balanced; rider on or off; barrel full or empty. The capacity of the barrel is 45 gallons, and the liquid is drawn from the bottom. Thorough agitation of the liquid is effected by means of two diagonal paddles. The pipe carrying the nozzles is placed in front of the wheels, thus making it possible for the barrel to be filled by a man standing on the ground. The pump is a rotary one and supplied with a small air chamber. The 'shut off' and 'out gear' movements are made by one handle. With slight alterations the machine can be adapted to orchard spraying. We have tested this machine through the whole of one season on seven acres of potatoes at Jamesport, L. I., and have found it quite satisfactory. It is manufactured by the Riverhead Agricultural Works, Riverhead, N. Y. Price, $75.00."
HOME MADE CONVENIENCES.

Spraying is hard, dirty work at best, and any machinery or method that will facilitate the work is eagerly sought. Many ideas for improvement that are adapted to the needs of different conditions will suggest themselves as the work progresses.
If in a large orchard a tank larger than a kerosene barrel is wanted it should be made of a round form so there will be no corners for the mixtures to settle in.

Where very tall trees are to be sprayed it may be advantageous to build a platform on the rear of the wagon for a man to stand on who is to spray the tops of the trees. The height of the platform will depend on the height of the trees to be sprayed. Fig. 12 shows such an outfit that was made here at the Experiment Station to be used in our orchards.

We have seen a very serviceable home made outfit for spraying potatoes. It consisted of a barrel pump mounted in a light one-horse wagon and by means of a hose and a few feet of gas pipe a simple arrangement was made to fasten to the rear of the wagon that four rows. By at-

extended out over taching nozzles at proper intervals to the pipe the four rows were sprayed as the wagon moved over them. With a boy to drive and a man to pump, a large amount of territory may be gotten over in a day with such an outfit. The same pump will of course serve to spray trees as well. By the exercise of ingenuity the necessity of

Fig. 12. A Home Made Outfit.
buying expensive apparatus may often times be avoided and the home made tools may be even more serviceable as they are made to suit the condition that exists on our own farms.

SUNDARY NOTES.

Nozzles.—In order to do the best work a nozzle should throw a fine mist-like spray that will float in the air and slowly settle. With such a spray nearly all of the leaf surface may be thinly coated with the minute particles and yet be almost unnoticed by the casual observer.

The best work cannot be done with a nozzle that throws a coarse spray, or by drenching the trees till the particles collect in drops on the leaves and branches and fall to the ground.

Each season brings its array of new and modified forms of nozzles, but for our work we have yet to find any nozzle that is as satisfactory as the Vermorel, providing that it is of the right pattern. Various forms are on the market, but those that have no joint between the nozzle chamber and elbow, are a source of annoyance, as the best of them sometimes become clogged in the elbow, and where there is no joint it is next to impossible to reach the obstruction. Vermorels that are not open to objection are illustrated in Figures 13 and 14,

The Vermorel produces a very fine mist-like spray, which it can throw but a very few feet beyond its orifice. Therefore where very tall trees are to be sprayed it may be necessary to use a nozzle that will throw a spray to a greater distance. The McGowen nozzle is quite satisfactory for such work. In any case it will be seen that where trees are to be sprayed the Vermorel nozzle must be lifted up among the branches. The bamboo extension was devised for this purpose.
Double discharge nozzles.—For most spraying it is advantageous to use more than one nozzle on a single line of hose, as the work can be done much quicker than when only one nozzle is used. Various forms of connections are manufactured for this purpose. Triple connections are also used where it is desired to use three nozzles on the same hose.

Bamboo extension.—This consists of a three-eighths inch brass tube inside of a bamboo pole. At the lower end of the tube is a stop-cock and hose connection, while the nozz'e is attached to the upper end. Several other methods of elevating the nozzle are used, such as the use of small iron or galvanized pipe, but this form is mentioned in particular for the reason that it is light and convenient to handle. Extensions may be made of any convenient length.

Bordeaux mixture.—There are several different formulas for making Bordeaux mixture, any one of which will no doubt give excellent results if the directions are closely followed. The formula given below has been used at this Station for the past five years, and it is also generally used by the fruit growers of this vicinity. In no case has it proven unreliable, so we do not hesitate to recommend it as being one of the best and certainly the quickest method by which Bordeaux mixture can be made. Much has been written of late for and against the practice of using the potassium ferrocyanide test for determining the amount of lime to be used, and many nice points have been brought forth as to just how this test should be applied. We still adhere to the common method of applying it, as we have always found it reliable:

Formula.—Copper sulphate................. 4 lbs.
Lime ........................................ 3 lbs.
Water ...................................... 45 gals.
Dissolve the copper sulphate in hot water or by suspending in a coarse cloth or bag in a considerable amount of cold water, so that the sulphate is just covered. It will not all dissolve if placed in the bottom of a vessel of cold water. When dissolved dilute the solution to two-thirds of the required amount. Next slake the lime and add it to the solution in the form of a thin white wash—the thinner the better. Strain it if necessary to keep out particles that would clog the nozzle. The mixture should be thoroughly stirred while the lime is being added. It is essential that the copper solution should be quite dilute before the lime is added, otherwise a heavy precipitate is formed.

Weighing the lime.—It is easy to see that the weighing and slaking of the required amount of lime each time a barrel full of the mixture is to be made will require a considerable amount of time in the course of a day, which at this busy season is quite an item. By using the color test the necessity of weighing the lime is done away with and enough lime may be slaked at one time to last through the season. A convenient way to keep the lime is to slake it in a barrel that is partially sunk in the ground, as is shown in figure 15. When treated in this manner it will keep indefinitely in the form of paste if the surface is kept covered with a small amount of water. It will be economy to buy a good quantity of fresh lime. Air slaked lime is worthless.
Potassium ferrocyanide test.—Fill the spray tank two-thirds full with the copper sulphate solution, then pour in the milk of lime. Stir the mixture thoroughly and add a drop of the potassium ferrocyanide. If enough lime has been added the drop will not change color when it strikes the mixture, otherwise it will immediately change to a dark reddish brown color. More lime must then be added until the ferrocyanide does not produce the reddish brown color. Even after the test shows no color more lime should be added so as to be sure that all of the copper will be precipitated, for in case the mixture has not been thoroughly stirred some of the copper may still remain in solution in the bottom of the barrel while the test shows no color at the surface.

An excess of lime will do no harm, while the free copper solution will injure the foliage.

The potassium ferrocyanide, or yellow prussiate of potash, is a poisonous yellow salt which readily dissolves in water. A few cents worth dissolved in about ten times its volume of water will last through the season.

Stock solution of copper sulphate.—Where a good deal of spraying is to be done it will be found advantageous to make up a stock solution of copper sulphate. This may be made by dissolving any number of pounds of the sulphate in one-half as many gallons of water. A gallon of the solution will contain two pounds of the sulphate, therefore two gallons will contain the required amount for a barrel of Bordeaux mixture. Suspend the sulphate in the top of the water, otherwise it will not all dissolve if the water is cold. The stock solution must be kept well covered in order to prevent evaporation.

Saturated solution of copper sulphate.—An up-to-date orchardist recently suggested that a saturated solution of copper sulphate would be more convenient than the ordinary stock solution as there would be no necessity of weighing the copper sulphate or of measuring the water. This gentleman has followed this plan for two seasons with good results. However this method can only be commended to careful men who will take pains to see that the solution is always a satu-
rated one. A large vessel of cold water is provided in which is suspended a large amount of copper sulphate, more than the water can possibly take up. This should be prepared at least a day before the solution is wanted for use in order that the sulphate may have time to dissolve. As the solution is taken out more water should be added to the vessel from time to time and copper sulphate should be constantly kept in suspension. By exercising a due amount of care a fairly even solution may be maintained. One gallon of water at ordinary temperature, 59° F. will dissolve 49 ounces of copper sulphate. Therefore one and one-third gallons of such a solution will contain the required four pounds of copper sulphate for a barrel of Bordeaux mixture.

Bordeaux mixture should be used soon after it is made, or at least on the same day that it is made, as it soon begins to deteriorate in value.

**Kerosene emulsion.**—Kerosene emulsion is made by dissolving one-half pound of common soap or whale oil soap in one gallon of soft water. Heat the mixture, and when boiling hot remove it from near the fire and add it to two gallons of kerosene. The whole is now thoroughly mixed by pumping continuously through a small force pump for about five minutes. Mix until the ingredients form a creamy mass that becomes thick when cool and from which the oil does not separate. When using on foliage dilute with from ten to fifteen parts of water; when used as a winter treatment it may be applied as strong as one part of the mixture to four parts of water. After the stock emulsion becomes cold it hardens so that it is necessary to melt it before it can be successfully diluted. It takes fire very readily, so it is always a safe plan to have a fire out of doors when making the emulsion. This emulsion is used to kill insects that have sucking mouth parts; it is not a poison but kills by contact.

When applying the mixture with pumps that have rubber balls for valves, it must not be forgotten to replace the balls with marbles as the kerosene soon destroys rubber. There is a large amount of whale oil soap of poor quality on the mar-
ket which accounts for trouble that some people experience in forming the emulsion. Only the better grades of whale oil soap should be used.

**Paris green.**—Paris Green is used to poison insects that have biting mouth parts. It may be applied either in the dry form or in a spray. When the spray is used the Paris green may be combined with Bordeaux mixture, or it may be applied mixed with water. In either case the same amount of poison is used. For pomaceous fruits, such as apple and pears, one pound of Paris green to one hundred and fifty or two hundred gallons is commonly used. For stone fruits the mixture should be weaker, using one pound of Paris green to two hundred and fifty or three hundred gallons. When used with water, two pounds of fresh slaked lime must be added for each pound of Paris green, to prevent injury to the foliage.

The adulteration of Paris green has come to be a great source of annoyance and loss to the farmer and fruit grower. There should be but one grade of Paris green and that the pure article, yet many dealers have different grades for sale. The cheaper goods must necessarily be adulterated. Where adulteration is suspected, if some of the poison is crushed between two pieces of window glass or between the thumb and finger, oftentimes the small lumps will be found to be white inside, showing that some adulterant has been used. The ammonia test which is very simple though not infallible may also be used. Pure Paris green will readily dissolve in ammonia and the solution will be of a deep blue color. If there is any residue left, or if the solution does not become blue at once, adulteration may be suspected.