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* Spraying and Dusting Potatoes

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THE ROWS ON THE LEFT WERE SPRAYED WITH BORDEAUX MIXTURE

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NEXT to the use of good seed, a thorough spraying or dusting of the vines for protection against foliage-destroying diseases and insects is one of the more important practices in the insurance of a profitable crop of potatoes. To neglect a practice as important as the efficient use of fungicides and insecticides is to penalize the crop through losses in yield and quality.

Early blight occurs in all parts of Minnesota and causes circular brown spots on the leaves and sometimes small shallow pits on the tubers.

Late blight occurs in eastern Minnesota in moist seasons, and the rapid death of the plants results in loss in yield as well as from rot in storage.

Potato leaf hoppers are found in all parts of Minnesota, and the evidence of injury on the plants occurs as a progressive drying of the tips and edges of the leaves. The adult potato leaf hopper is about $\frac{1}{8}$ inch long, is green in color, and feeds by puncturing the leaf and sucking out the juices.

The potato flea beetle also is found in all parts of the state. It causes injury by making tiny pinholes in the leaves. The flea beetle is black, $\frac{1}{16}$ inch in diameter, and hops like a flea when disturbed.

The Colorado potato beetle and the injury that it causes on the leaves are too well known to require description.

Follow a Regular Spray or Dust Program

Bordeaux-mixture spray or copper-lime dust, when properly applied, will control or greatly reduce the losses from early blight, late blight, leaf hopper, and flea beetle.

Poison can be added to control Colorado potato beetles. A cheap arsenical poison such as calcium arsenate is used quite generally for this purpose. It can be applied either as a spray or as a dust at the rate of 4 to 6 pounds an acre, depending on the equipment used.

In the control of potato leaf hoppers

and flea beetles, arsenical poisons alone are not effective.

While Bordeaux mixture and copper-lime dust are economically efficient fungicides for the control of blights, they are also effective in reducing losses from leaf hoppers and flea beetles. Under certain growing conditions, the copper in Bordeaux mixture or in copper-lime dust has a stimulating effect on the foliage even though no diseases or insects are present in the nearby territory. It is customary to apply Bordeaux mixture or copper-lime dust in 4 or 6 applications at 10-day intervals, starting when the plants are 6 inches high. The 6 applications should be applied in eastern Minnesota where late blight is likely to occur.

If Colorado potato beetles are present in the field, add an arsenical poison such as calcium arsenate to the Bordeaux mixture or copper-lime dust.

The use of Bordeaux mixture on potatoes requires more labor but the cost of materials is less than when copper-lime dust is used. Copper-lime dust should be applied at night or early in the morning when the leaves are wet with dew, for greatest efficiency. Bordeaux mixture can be applied at any time, but preferably when the leaves are dry. Since the results from copper-lime dust applied under favorable conditions are almost as good as from Bordeaux mixture, local conditions will determine which to use.

Potato growers with less than 5 acres generally use hand equipment for applying insecticides and fungicides. The labor of carrying 800 pounds of water as compared with 30 pounds of dust is a strong argument in favor of dusting when hand equipment is used. Scarcity of water near the potato field, or the saving of time in refilling machines, is a factor to be considered in choosing equipment for large acreages. A sprayer with 3 nozzles to the row and a pump that will maintain a pressure of 250 to 300 pounds to the square inch will apply about 100 gallons of spray per acre.

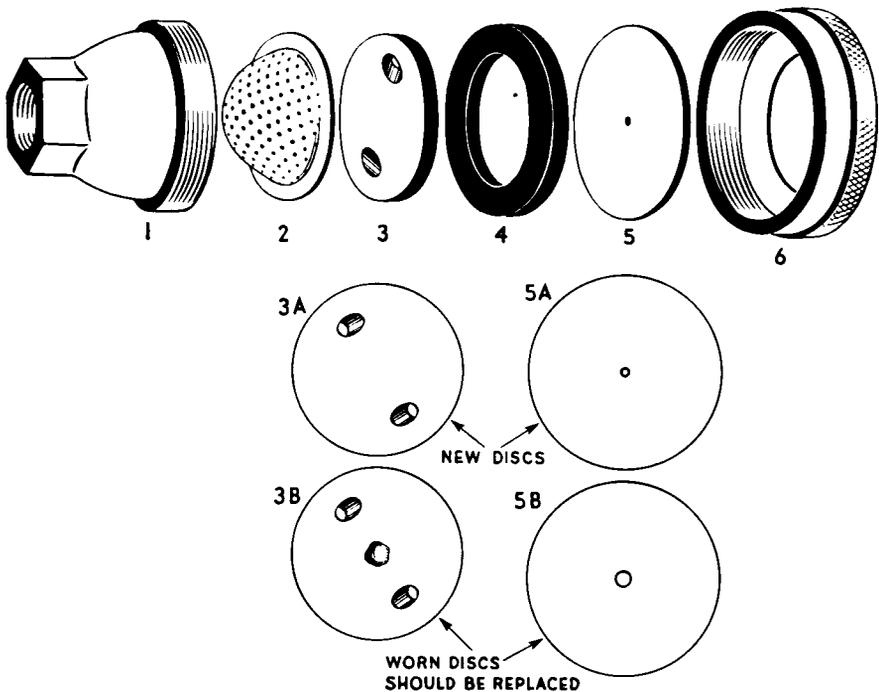


Fig. 1. Necessary parts to a spray nozzle: (1) base, (2) strainer, (3) whirl disc, (4) rubber gasket, (5) spray disc, (6) cap. 3A, whirl disc before wear; 3B, whirl disc showing wear in center from gritty material in spray mixture. 5A, spray disc before wear; 5B, spray disc with enlarged hole caused by wear.

A traction or power duster with 2 nozzles to the row should apply 30 pounds of 20-80 copper-lime dust or 25 pounds of 25-75 copper-lime dust to the acre.

Stock Solutions for Bordeaux Mixture

Although this method of preparation requires extra equipment such as barrels and buckets, it gives greater assurance of a better quality to the mixture. Stock solutions of copper sulphate and lime are first made up in two separate 50-gallon barrels. A wooden barrel is necessary for the copper-sulphate solution because of the chemical action of the solution on metals. If a wooden barrel is not available, a steel barrel with several coats of asphaltum paint on the inner surface may be substituted.

To make a copper-sulphate stock solution, place 40 pounds of copper sulphate (either crystal or granulated) in a clean burlap bag and hang in 40 gallons of water in the wooden barrel. If the copper sulphate is kept just below the water surface, it will dissolve in a few hours or over night.

In a second barrel place 40 pounds of hydrated lime (finishing lime or special spray lime) and stir thoroughly while adding 40 gallons of water.

These stock solutions will keep indefinitely, but they should be kept covered to keep out dirt and rain and to prevent evaporation.

Mixing a 5-5-50 Bordeaux Mixture

To prepare Bordeaux mixture in a 100-gallon sprayer tank, fill the tank two-thirds full of water and add 10

gallons of copper-sulphate stock solution. Agitate thoroughly and add slowly 10 gallons of lime stock solution, while the mixture is being vigorously churned or stirred. Always stir the solutions thoroughly before dipping out portions needed for the mixture.

The loss of water from the leaves of plants sprayed with Bordeaux mixture is increased when larger amounts of lime are used in the mixture.

Recent tests with a 5-2½-50 Bordeaux mixture indicate that it may be possible to use half the regular amount of lime in the formula. However, the 5-2½-50 formula should be tested under various conditions before adopting it exclusively.

Instant Bordeaux Mixture

A quick method of preparing Bordeaux mixture is sometimes used in place of the stock-solution method. This permits the preparation of the mixture in the sprayer tank. It saves time and eliminates the extra equipment necessary in preparing the standard mixture, but it seems to be best adapted to sprayers that have power-driven or hand-operated agitators.

This method requires a special grade of granulated copper sulphate known on the market as "copper-sulphate snow" or "pulverized bluestone". This fine grade of copper sulphate will dissolve in cold water in a minute and a half when briskly agitated. A chemically hydrated lime is also essential. The lime should be of an extra fine quality that will pass through a 300-mesh sieve and is sometimes known on the market as spray lime. This better grade of lime not only insures a better mixture but reduces wear on the sprayer and time lost in cleaning clogged nozzles.

Mixing a 5-5-50 Instant Bordeaux Mixture

Fill a 100-gallon sprayer tank one-fourth full of water. Pour 10 pounds of copper sulphate (snow) on the in-

take strainer or in a sugar sack substituted for the strainer and allow it to dissolve in the water that is poured or run into the tank. Keep the agitator in operation while the copper sulphate is dissolving.

The "snow" should be dissolved when the tank is three-fourths full; if not, pour a kettle of hot water on what is left. Mix 10 pounds of chemically hydrated lime with enough water to make a creamy mixture and pour it through the strainer with the inflowing water. Keep the agitator moving while adding the lime water. The calcium arsenate or other poisons can then be added for controlling Colorado potato beetles. Mix it with water in a small container to make a thin paste and strain.

Four pounds of calcium arsenate per 100 gallons of Bordeaux mixture will usually take care of the Colorado beetles. Continue to add water and agitate the mixture until the tank is full. The mixture is now ready to use and should be applied at once. If it is impossible to use the Bordeaux mixture within a few hours because of weather or breakdown, a heaping teaspoonful of sugar dissolved in a cup of water should be added to each 50 gallons of spray mixture. This will preserve the Bordeaux mixture for several days or longer.

Copper-Lime Dust

Under many conditions potato growers prefer to use a dust rather than liquid sprays even though it costs more.

Commercially prepared copper-lime dust in airtight containers can be purchased in many potato districts. However, if a potato grower wishes to prepare his own dust, he may do so if a mixer or barrel churn is available. A 20-80 dust is one that contains 20 per cent monohydrated copper sulphate and 80 per cent hydrated lime. When it is necessary to add a poison for leaf-eating insects, a 20-20-60 dust is made by mixing 20 pounds of calcium arsenate, 20 pounds monohydrated copper sulphate, and 60 pounds of hydrated

lime. It is usually more convenient to add 17 pounds of monohydrated copper sulphate and 17 pounds of calcium arsenate to a 50-pound sack of lime. When poison is not needed, simply add 12½ pounds of copper sulphate to a 50-pound sack of lime. Monohydrated copper sulphate and the mixed dust should be stored in an airtight container in a dry location. Exposure causes a change in color from white to gray or brown, and the material hardens into a solid mass. If weathered, it is useless.

In spraying with Bordeaux mixture, it is usually estimated that a good sprayer with 3 nozzles to the row will use 100 gallons of spray to the acre to insure good coverage of the foliage. To get the equivalent of 10 pounds of

copper sulphate to the acre in one application, it will be necessary to use 37½ pounds of 20-80 or 20-20-60 copper-lime dust per acre at each application. If a 25-75 or a 25-25-50 dust is used, use only 30 pounds per acre at each dusting. Dust containing more than 25 per cent monohydrated copper sulphate may cause foliage injury.

Spraying and Dusting Equipment

The acreage that is to be served will determine the size and kind of equipment that can be used economically. Potato growers with less than 5 acres should either consider hand dusters or join with a few neighbors and organize a spray ring. Crank-type hand dusters that cost from \$10 to \$25 are well adapted for these smaller fields. Most

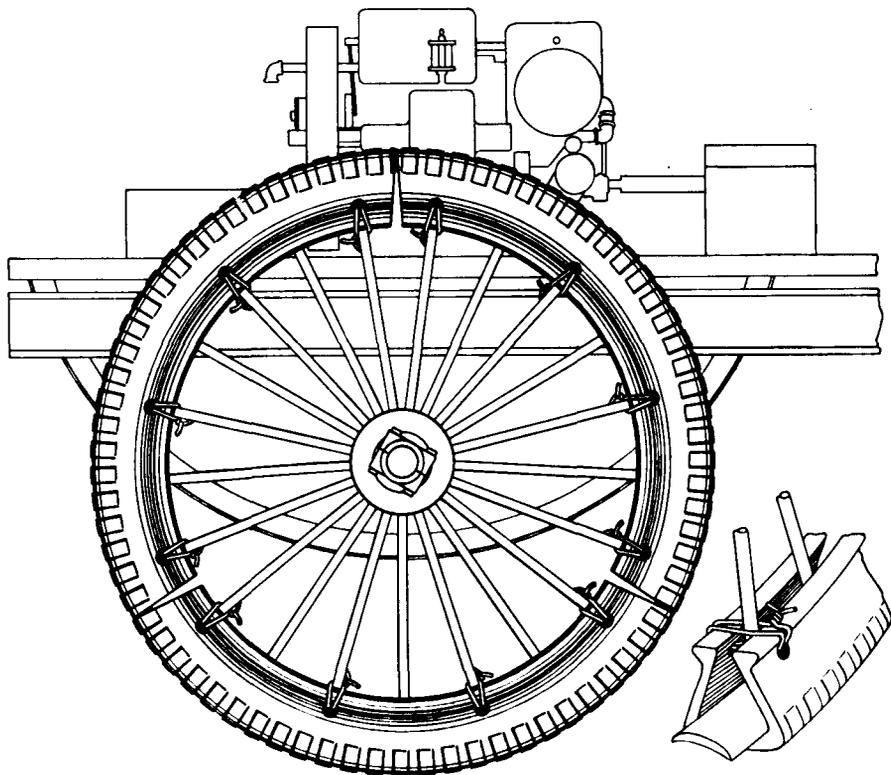


Fig. 2. Old auto tires fastened to rims of steel wheels reduce vine and root damage from sprayers and dusters.

of these dusters are made to apply dust to two rows at a time, and at average speed a man can dust one acre in one hour.

Potato growers raising from 5 to 20 acres of potatoes will find traction sprayers or dusters better suited to their needs. A good high-pressure traction sprayer should be well built and have a spray boom that will cover 4 rows, with 3 nozzles to a row.

Power sprayers are now made that will spray as many as 12 rows at one time. A dust mixer is another feature that has been added to some of the more elaborate row-crop dusters. This enables the grower to do his own mixing and application in one operation.

Operation of Sprayers and Dusters

Spraying and dusting equipment needs attention and care to secure the best results. One of the first difficulties encountered in using a sprayer is the loss of pressure and of material owing to worn discs in the nozzles. The force of the spray and the gritty material sometimes found in lime are responsible for enlarging the center holes (fig. 1, 5A and 5B) of the spray discs and wearing new holes in the whirl discs (fig. 1, 3A and 3B). When coarser grades of lime are used in Bordeaux mixture, wear on the discs increases and the nozzles clog frequently. The discs should be checked at regular intervals and should usually be replaced after spraying 65 or 75 acres.

The copper strainers in the nozzles and in other parts of the sprayer sometimes become so clogged with spray residue that it interferes with the volume of spray. The residue can be removed instantly by quickly dipping the strainers into a small amount of muriatic acid in a glass or teacup and then rinsing the acid off in water.

The acid can be applied to the larger strainers with an old paint brush and then rinsed off by dipping in water.

Avoid Wheel Damage

Unnecessary wheel damage to plants should be avoided as far as possible. Vine lifters for sprayers, dusters, and tractors can be obtained from some of the manufacturers. It is not difficult to construct efficient homemade vine lifters from old hay-rake teeth. Attach them to the machine so as to raise the vines while the wheels pass.

Machines with narrow-rimmed iron wheels damage vines, roots, or tubers by cutting into the soil. Covering the wheel rims with old automobile tires (fig. 2) reduces this type of injury.

Adjustment and Care of Equipment

Sprayer and duster nozzles should be set at a proper distance from the row and at correct angles to insure **best** coverage. The nozzles of a **sprayer** with 3 nozzles to the row **should** be arranged so that the 3 cones of **spray** will cover the plants with **very little** overlapping. The duster **nozzles should** aim at the base of the **plants from** a 45-degree angle so **as to roll** the dust under the plant. **The nozzles should** be readjusted as **the plants grow** larger.

It is highly **important that** sprayers and dusters **be well lubricated** while in use and **stored under cover** when not being used. **At the end** of each day when the **sprayer** is being used, it should be drained and flushed out with clean water pumped through the pipes and nozzles. At the end of the season, the sprayer should be cleaned and the boom and nozzles taken apart and stored in oil. It is advisable to pump a small amount of filtered crankcase oil through the machine before putting it away for the winter.

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