Applying The Chemicals

Spraying is the application of a chemical to a plant in liquid form; **dusting** the application of a fine dry powder. The difference between spraying and dusting was very clear-cut before aerosol bombs, mist blowers, and fog machines were developed to apply liquids in such concentrated form that the particles are practically dry before they reach the plant and before spray-dusters were made to deliver wetted dusts.

Sprayers vary from a flit gun or pint atomizer, which takes an hour to discharge a gallon, to power apparatus that discharges 60 gallons a minute at 800 pounds pressure from a 600-gallon spray tank. Dusters vary from the small cardboard or plastic carton in which the dust is purchased to helicopters. Applicators for pressurize sprays or aerosols vary from the one-pound "bomb" to truck-mounted fog generators or air blast machines. See Fig. 1 for various applicators.

Mist Sprayers

In orchards and in shade tree work there has been increasing use of mist blowers, air blast machines that carry droplets of concentrated pesticides to plants in air rather than water. They are speedier than hydraulic sprayers, use far less water, which may be scarce in times of drought, and do not leave puddles or poisonous run-off which may be dangerous to pets and birds. They cannot, however, be operated in much wind; for that reason, and also in order to see the distribution of the concentrates, they often have to be used at night. They are not too efficient for very tall trees, and the droplet size has to be rather carefully regulated. Too large drops may fall out before they reach a tree, and too small drops may not settle down but go on past.

Although we usually think of mist blowers on trucks for large scale operations, there are now some about the size of knapsack sprayers that, engine and all, are worn on the back around the garden. They weigh around 35 pounds and will cover foliage up to 30 feet. They cost, however, somewhat more than the hydraulic power sprayers of small estate size.

Hydraulic Sprayers

Mist blowers will probably never entirely outmode hydraulic sprayers, which can place the spray more accurately, at a greater height, and can operate under more unfavorable weather conditions. For trees, high gallonage per minute and enough pressure to drive sprays high in the air have advantages, but for garden plants the emphasis should be on cutting down gallonage and pressure.

Power sprayers for home gardens are available in almost any size, from 5-gallon capacity on up, and may have gasoline or electric motors (see Fig. 2). For the orchard a spray gun is

R.K. Horst, *Westcott's Plant Disease Handbook*, DOI 10.1007/978-94-007-2141-8_5,

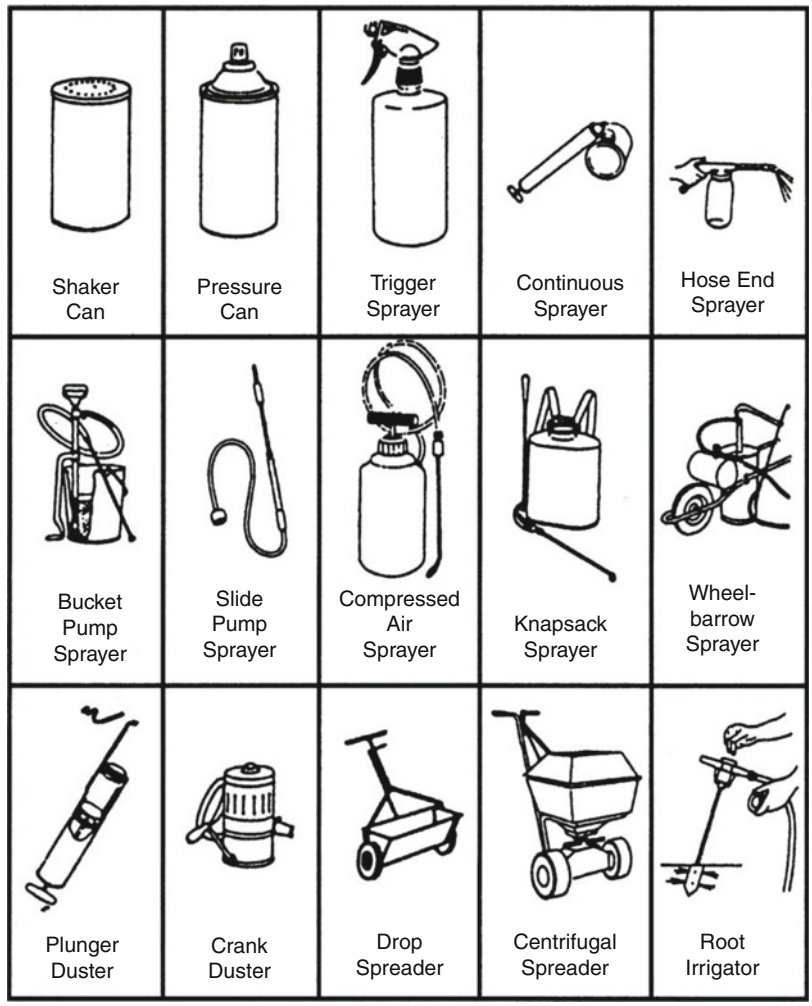

Figure 1 Aerosol pressurized spray

Figure 2 Spray application techniques

satisfactory, but for flowering shrubs–azaleas, roses, etc.–a spray rod, curved at the end, or with an angle nozzle, is easier on the plants and more effective, allowing for better coverage of underside of foliage.

The size of the hole in the nozzle disc and the pressure determine the amount of spray used. The volume of spray ejected per minute doubles or triples with each small increase in the hole size or pressure used. This means that in a home garden where the objective is to cover a few rose bushes effectively a large amount of spray can be wasted at too high pressure, an expensive item with many pesticide mixtures costing 20 to 30 cents a diluted gallon. Most chemicals are corrosive, and even if

you start with a mist nozzle with a small hole at the beginning of the season, you will soon be delivering more spray per minute because the hole is enlarging. This usually means more conspicuous residue left on the plant as well as more expense.

Hand-Operated Sprayers

"Aerosol bombs" are pressurized sprays in push-button containers. A gas propellant reduced to liquid form is added to a pesticide concentrate and a fine mist is released when the button is pushed. Unless the container is held 12 to 18 inches away from plants, to allow the gas to evaporate, there will be some burning (more literally a freezing) when the liquid gas hits foliage. Such cans are good for house plants and for spot treatment of insects outdoors, but air currents make it difficult to place fungicides effectively. Aerosols are also used for the application of wound dressings to trees. (See Fig. 3).

Household sprayers of the atomizer type are intermittent, discharging spray material with each forward stroke of the pump, or continuous, maintaining constant pressure. They are too small and too tiresome to operate for more than a few plants, and it is hard to get adequate coverage of underside of foliage.

Compressed air sprayers are adequate for small gardens and are relatively inexpensive. Capacity varies from 1 to 6 gallons. They are meant to be carried slung over one shoulder, but some come mounted on a cart. Air is compressed into the tank above the spray liquid by a hand-operated pump. A short hose, extension rod, and adjustable nozzle make it possible to cover undersurfaces. Such sprayers are a bit hard to pump up, and some models have carbon dioxide cylinders to provide operating pressure.

Knapsack sprayers, of 2 to 6 gallons capacity, are carried on the back of the operator and are pumped by moving a lever up and down with the right hand as you spray with the left. These are more expensive than compressed air sprayers, but deliver a fine continuous mist and are excellent for larger gardens.

Figure 3 Pesticide application equipment (Modified from the National Sprayer and Duster Association)

Slide or trombone sprayers have a telescoping plunger, operated with two hands. They draw material from an attached jar or separate pail and discharge it as a continuous spray. They develop good pressure and can be used for small trees, but are tiring to use.

Wheelbarrow sprayers are manually operated hydraulic sprayers, holding 7 to 18 gallons, that are mounted on a frame with wheelbarrow-type handles and one or two wheels. Pressures up to 250 pounds may be developed, providing excellent coverage for shrubs and small trees. This type works best with two people, one to control the pump, the other to operate the spray rod. Hose-end sprayers are attached to the garden hose so that water supplies the pressure. The action is that of a siphon. The concentrated pesticide is placed in a jar, and as water under pressure is passed over the metering jet a small amount of chemical is drawn into it. This is a very easy way to spray, and some models are relatively accurate in materials discharged. Be sure to purchase a type with an extension tube and deflector, so that spray can be directed to underside of the foliage, with a shut-off at the jar, not just back at the hose, and with a device to prevent back-siphonage. Hose-end sprayers can be used for roses and other shrubs and for low trees. The droplets may be somewhat larger than those from a wheelbarrow or knapsack sprayer, and slightly more chemical may be used.

Dusters

Pesticide dusts are most often made with talcs, pyrophyllite, clays, calcium carbonate, precipitated hydrated silicates and silicon dioxides, synthetic calcium silicate and diatomaceous earth as the diluents although finely ground plant material such as tobacco dust or walnut shell flour is sometimes used.

In some cases, a solution of the toxicant in a volatile organic solvent such as acetone or benzene is mixed with the dust diluents, the solvent allowed to evaporate, and the mixture then ground. A solution of toxicant may be sprayed on the dust diluent during mixing and grinding or the toxicant dissolved in a nonvolatile solvent and mixed with the diluent. When this is done, care must be taken to avoid an excess of solvent that might impair dusting qualities of the finished product. Many technical pesticides in solid form lend themselves to direct grinding with a sorptive clay carrier in adequate milling equipment. Field strength dusts may be produced by diluting or cutting down dust concentrates which contain from 10 to 50 % a.i. (Dust Bases). Because of their good dusting properties, attapulgites, diatomite, talc, pyrophyllite, kaolins, and treated calcium carbonate are used as diluents to provide the volume per acre needed to facilitate metering of the dust through the duster mechanism. Since many formulations contain more than one a.i., dry concentrates must have the proper qualities to make a good formulation with relatively little or no diluent. From a toxicity standpoint, it is desirable to have a very small particle size, since immediate toxicity is generally inversely proportional to particle size. There are several important disadvantages to extremely small particle size: high wind losses, more or less rapid volatilization and the prohibitive cost of extremely fine grinding. Also, to obtain better toxicant exposure of technical concentrates absorbed on a carrier, it is desirable to have the extender or diluent in as large a particle size as possible and still give good dusting characteristics. In a 5 % dust effective toxicant exposure is obtained with the extender averaging 10 times the size of the toxicant particles. At present, particle size specifications are usually 10 to 30 μm for ground dusters and 20 to 40 μm for aircraft units. For use in fertilizer mixtures, granulated powders of 20 to 80 mesh are prepared by impregnation of Fuller's earth and bentonite fractions with the desired toxicants.

Some dusts are sold in a can with a shaker top, meant to be applied like salt, which is certainly not going to place a fungicide where it will do the most good. Some dusts are sold in small cardboard cylinders to be used as dusters, which work for a little while if the cardboard is well paraffined to slide easily; but the dust soon gets damp and clogs. Many more dusts are sold in plastic containers, with the dust supposedly coming out in clouds as you squeeze, but more often it doesn't after the first few days. Dusts are tricky to use because of these disadvantages.