Beware of the Hazards of Spray Mist Drift!

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DURING the last few years poisonings by pesticides have received widespread publicity. In many cases this has resulted in an unjustified fear of all pesticides. Many individuals become concerned when any spray is used in their neighborhood.

Good public relations are necessary for every business, but are even more important in the horticultural spray industry. The neighbors and friends of our present customers form a pool from which we hope to draw new business. Yet an occasional sprayman may tend to irritate these prospective clients by allowing spray mist to drift onto their property. The resulting fear and ill will are the most common problems created by spray drift.

The dangers of these mists can be divided into the actual and imagined. We are all aware that actual dangers depend on the toxicity of the pesticide being used and the amount to which an individual is exposed. If highly toxic pesticides, such as parathion, are being used, the dangers from spray drift can be quite real.

This safety-conscious, masked serviceman is spraying with a homemade gun constructed from galvanized pipe. Note the pressure gauge that is being used for calibration, a necessity when regulating pressure to avoid drift hazard.

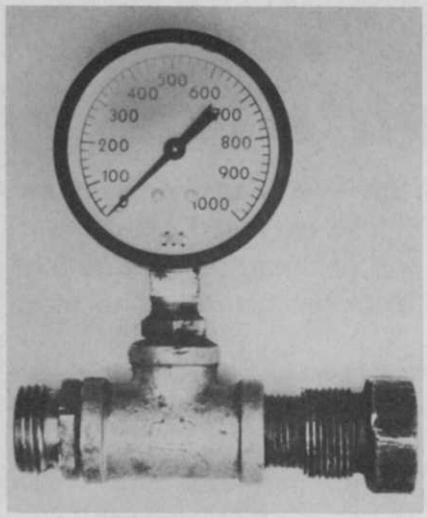
Frequently, the majority of complaints with which a sprayman must cope are imagined dangers. Many of us tend to disregard these "nuts," but to the person involved, the dangers are quite real. Occasionally an individual may go to great lengths to try to prove that he was harmed in some way. In Miami, for example, a neighbor's maid claimed she was poisoned by spray mist that had traveled over a masonry wall and through a louvered window. Over a year later she brought suit against the spray company concerned and was awarded damages by the court. Her case was based on the fact that even though she was not physically harmed, her fear of the pesticide had caused permanent psychological damage.

The relatively new field of herbicide application presents a major spray drift problem. Some herbicides, such as 2,4-D and 2,4,5-T, are capable of killing certain plants in extremely small dosages. In agricultural areas, cotton, tomatoes and peppers have proven very sensitive to these materials. Floridians use hibiscus, althea, and mallows, which are closely related plants, as ornamentals. These and many other plants can be damaged or even killed by spray drift of some herbicides. Replacement of full-grown ornamental plants can be expensive.

Origin of Spray Drift

Since spray drift can create unnecessary problems, it is to our advantage to prevent it. Drift consists of small spray particles or mist that is being carried by the wind. This mist is formed in one of three ways: at or shortly after leaving the nozzle (threads and filaments), in the air (shatter), or on impact.

When a liquid is forced through a simple nozzle or hole, it emerges as a solid stream. Air resistance causes constrictions and bulges, which are eventually pinched off as droplets. As the stream is broken up into drops, the last thin connecting filaments break up into small particles. The higher the droplet velocity, the greater the



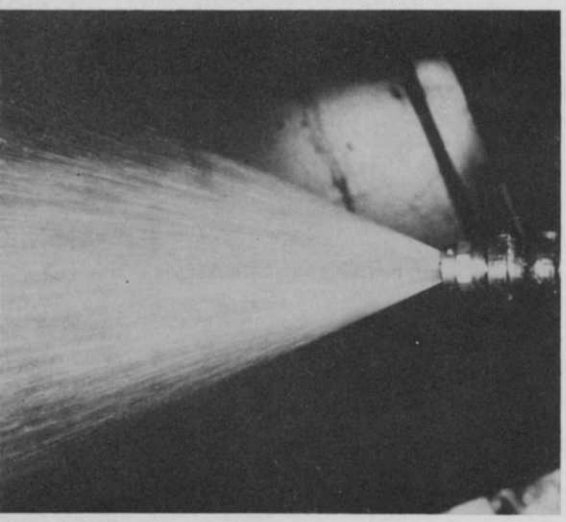
Pressure gauges can be inserted between the operator's spray gun and hose. This method is not as accurate in determinating nozzle pressures as other means discussed in this article, but frequently this device is more convenient.

length of these filaments with a resulting increase in mist formation.

If the liquid is made to rotate before passing through the nozzle orifice, it will form a hollow cone. This cone emerges from the nozzle as a solid sheet; but due to centrifugal force and air resistance, it breaks up into slender threads which finally shatter to form droplets.

The shattering of spray droplets in the air is caused by "bagging" or "ballooning." When a high-velocity droplet encounters air resistance, it is flattened into a lens shape. As air pressure continues to act upon the droplet, the center is blown out into a balloon or hollow bag that is attached to a roughly circular rim. Continued air pressure causes the bag to burst into many small aerosol-sized particles. The rim of the particle also shatters, but the droplets are much larger than those formed from the bag. The rim contains approximately 70% of the spray droplet.

Flooding type nozzles like this produce a coarse, driving spray in a flat fan pattern, which is ideal for lawn spraying.



If the secondary droplets are traveling in excess of their critical velocity, they in turn will shatter due to this bagging phenomenon.

Brown[1] states that as much as 25% of a spray may be lost as mist. Lane[2] found that as much as 30% of a spray was reduced to aerosol or fog-sized particles in the shattering process that occurs when high-velocity droplets meet air resistance. This figure does not include the mist formed at the nozzle or on impact.

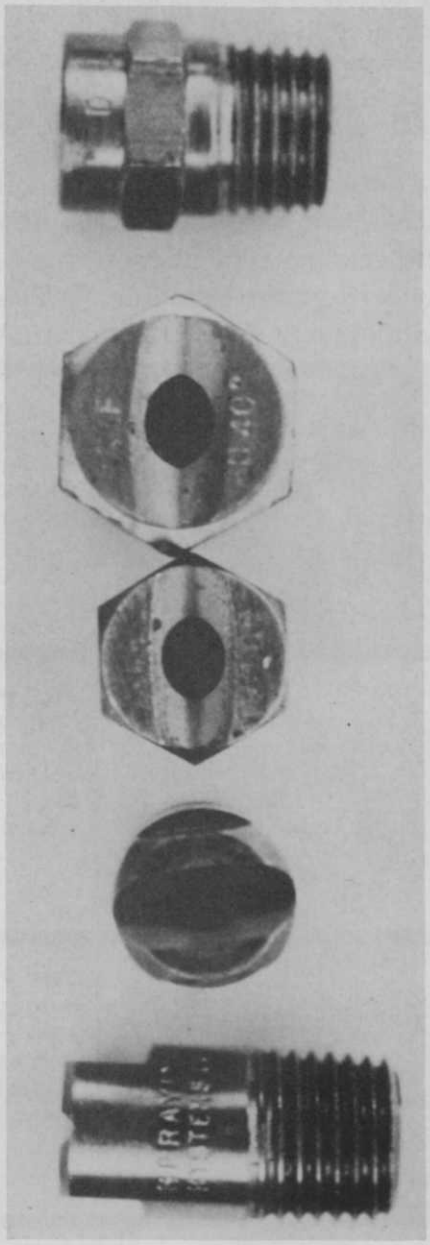
When a droplet encounters a solid surface, it shatters. The degree of shatter is proportionate to the velocity of the droplet at the time of impact. High-velocity droplets shatter into many very small droplets.

Use Low Velocity Sprays

The higher the pressure that is used to force a spray through the nozzle orifice, the greater the velocity of the resulting spray droplets. The higher the velocity of a droplet, the greater the tendency to form mist by each of the above methods. Therefore, to prevent mist formation, we should use low velocity (low pressure) sprays.

The common spray gun is designed around a hollow cone or disc-type nozzle. In this type nozzle a swirlplate is used to cause the characteristic hollow cone spray pattern. This plate has several spirally arranged holes that cause the liquid to whirl around in an eddy chamber before passing through the nozzle orifice.

The adjustable spray gun has a provision for bypassing the swirlplate, so that a solid stream spray pattern is formed. When this type gun is adjusted for a hollow cone spray pattern, the centrifugal force created by the swirlplate causes the liquid to leave the nozzle as a rotating hollow cone, which first appears as a sheet, then threads, and finally many very small particles. This characteristic and the resulting mist make this type nozzle unsuitable for applying highly toxic pesticides in residential areas.



These nozzles, of the flooding type, are well suited to the safe sprayman's needs. Spraying System's Vee-Jets (bottom), and Delavan's WF Series (top), are recommended by author Wilson.

During the early days of lawn spraying in Florida, all jobs were custom work. As the industry grew and competition increased, there has been a conversion to mass production techniques. With this change the time required on a spray job became more important, and spraymen began to work to increase the gallons per minute these spray machines can apply. The first attempts at overcoming this problem involved increased pressure. It was soon discovered, however, that tremendous pressures were required to push high

1. A. W. A. Brown, *Insect Control by Chemicals*, John Wiley and Sons, Inc., New York City, 1951.
2. W. R. Lane, "Shatter of Drops in Streams of Air," *Industrial and Engineering Chemistry*, Vol. 43, 1951, pp. 1312 through 1317.

gallonage through the relatively small orifice of the largest disc. Therefore, it became necessary to find a new type nozzle.

Vee-Jet and Delavan Nozzles Used

Spraying Systems Vee-Jets and Delavan WF Series nozzles were "discovered" as a result of this search. Both of these series had originally been designed for industrial application and to act as high-volume, flooding-type nozzles. These nozzles have an oblong orifice located in a milled slot on the surface of the nozzle face. They are available in various sizes, from those that handle a fraction of a gallon per minute, up to those that deliver 40 gallons per minute at 40 pounds pressure. They deliver a coarse, driving spray in a flat fan pattern that is ideal for lawn spraying.

Both manufacturers make their nozzles with standard pipe thread, which simplifies the construction of your own spray gun from galvanized pipe.

The choice of pressure is equally as important as the choice of nozzles in the prevention of mist formation. Vee-Jets and Delavan's WF's produce a minimum of mist when operated at 80 psi or less *at the nozzle*. This can be checked by a pressure gauge mounted on a pipe "T." This "T" is inserted between the nozzle and the gun.

Both manufacturers publish performance tables for their respective nozzles. These tables show the gallons per minute delivered by each size nozzle at various pressures. Therefore, if we know the nozzle size and the nozzle operating pressure, we can determine the gallons delivered per minute by consulting the tables. This method can be used as a quick way of calibrating your spray machine.

In summary, control of spray drift or mist is important in maintaining good public relations. The choice of nozzle and the pressure at which this nozzle is operated are the two major factors in preventing mist formation.

Editor's note: More information about the nozzles discussed here may be obtained from Spraying Systems Co., 3201 Randolph St., Bellwood, Ill., or Delavan Mfg. Co., Grand Ave. and Fourth St., West Des Moines, Iowa. Both manufacturers supply specification charts covering the equipment discussed in Mr. Wilson's article.

Handy USDA Guide to Respirato

WITH all the recent attention to pesticides and the concern over their safe use, contract applicators will be particularly interested in safety information contained in a recent bulletin from the U. S. Department of Agriculture. This new brochure, called "Respiratory Devices for Protection against Certain Pesticides" (ARS-33-76), has valuable pointers for spraymen, and includes the chart reproduced on the next page.

Scientists from USDA's Entomology Research Service, who compiled the data, hasten to point out that respirators do *not* provide needed protection from inhalation of pesticide dusts, mists, and vapors for operators formulating or mixing pesticides in closed or inadequately ventilated spaces. "Full-face gas masks equipped with tested canisters are worn under these conditions," the bulletin states. In addition, if servicemen are working in closed spaces, proper protective clothing, as specified on pesticide labels, must be worn.

Use of respiratory protective devices does not eliminate the need for other precautions in handling toxic chemicals. Rubber gloves and clean clothing are a must, and adequate hygienic practices are necessary.

When a serviceman shows any signs of dizziness or nausea, he should be removed from the treatment area immediately and placed in the care of a physician. Management should supply company doctors with all available information about pesticides used from day-to-day, so that illness resulting from accidents can be properly diagnosed.

FOOTNOTES TO CHART AT RIGHT

Respirators With Face-Mounted Cartridges

A. Respirator No. 5055, equipped with R-55 filter and cartridge unit. Two units attached to facepiece. (American Optical Co., Safety Division)

B. Healthguard Respirator style 95, equipped with Code B cartridge and filter 1000 or 1001. One unit attached to facepiece. (Chicago Eye Shield Co.)

C. DCA 6100 Respirator, with Para-A cartridge and DC 6100-7 felt filter. (Pulmosan Safety Equipment Corp.)

D. Agrisol Dust and Vapor Respirator, equipped with R-414 filter and 11-A cartridge. Two units attached to facepiece. (Ray-O-Vac Co., Willson Products Division)

E. Respirator No. 5561, equipped with filter cartridge combination R-561. (American Optical Co., Safety Division)

F. Farm Spray Respirator No. CR-72183, equipped with cartridge No. CR-49293 and filter No. 73488. (Mine Safety Appliances Co.)

G. All Vision Chemical Cartridge Respirator No. CR-74910, equipped with inner cartridge No. CR-73841 and outer cartridge No. 73927. (Mine Safety Appliances Co.)

H. Agritox Respirator, equipped with cartridge No. 11A (new type) and filter No. R490. (Ray-O-Vac Co., Willson Products Division)

I. Respirator No. 5058, with filter-cartridge combination R-58. (American Optical Co., Safety Division)

J. C-241 Respirator, with CMP cartridge and C-241-7 filter. (Pulmosan Safety Equipment Corp.)

K. Gasfoe Respirator No. CM-86007, equipped with cartridge No. CM-76883 and mineral-wool filter No. CM-79786. (Mine Safety Appliances Co.)

Supplied-Air Respirators

a. Whitecap Model SU-1 with No. 901 rubberized shroud, No. 301 cartridge, and No. 101 filter element. (Jamieson Laboratories, Inc.)

b. Same as L, except with extra fine No. 102 filter element. (Jamieson Laboratories, Inc.)

Gas-Mask Canisters

1. Chin Style (282-OVAG-F) Insecticide Canister. (Acme Protection Equipment Co.)
2. Canister GMC-1. (Mine Safety Appliances Co.)
3. Canister G3FD. (Ray-O-Vac Co., Willson Products Division)
4. Universal-type canister of any manufacturer. Type N, bearing Bureau of Mines approval.
5. Military Canister No. 084-Military. (Acme Protection Equipment Co.)
6. Canister No. H-3, equipped with facepiece filter holder and throwaway filter No. R361 or R393. Can be obtained with either a full-face gas mask or a half-mask facepiece. The half-mask facepiece should not be used when mixing or handling insecticides in enclosed spaces or applying aerosols in greenhouses, but is suitable for field use. (Ray-O-Vac Co., Willson Products Division)
7. Canister No. 3235 Type C-40. (Davis Emergency Equipment Co.)

The addresses of the companies supplying these respirators and gas masks are given below. Respirators are also available from pesticides distributors and mail-order houses.

Acme Protection Equipment Co.,
1201 Kalamazoo St., South Haven, Mich.

American Optical Co.,
Safety Division, Southbridge, Mass.

Chicago Eye Shield Co.,
2300 Warren Blvd., Chicago, Ill.

Davis Emergency Equipment Co.,
45-57 Halleck St., Newark 4, N.J.

Jamieson Laboratories, Inc.,
7900 Haskell Ave., Van Nuys, Calif.

Mine Safety Appliances Co.,
201 North Braddock Ave., Pittsburgh 8, Pa.

Pulmosan Safety Equipment Corp.,
644 Pacific St., Brooklyn 17, N.Y.

Ray-O-Vac Co.,
Willson Products Division, Reading, Pa.