SPRAY DRIFT CONCERNS

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It is possible for any liquid spray mixture to drift away from the intended site of application under the proper conditions. Every applicator should be aware of the potential for drift of spray particles and possible injury to non-target organisms every time he applies a pesticide. The consensus of several authors is that if spray applications consisting of droplets of 300 microns or greater are made, there is very little potential for drift (Dow, 1983, Klingman and Ashton, 1982, Warren, 1976). Droplets of 100 microns or less are particularly susceptible to drift and their numbers should be minimized. To control drift, the factors contributing to the formation of these fine spray particles must first be understood.

Spray drift can be broadly defined as the movement of spray particles away from the target area. Klingman and Ashton (1982) report that the amount of spray drift is dependent upon the size of the droplets, the amount of wind and the height above the ground that the spray is released. The size of droplets produced by a given nozzle is dependent upon the type of nozzle, the angle of the nozzle and the pressure exerted at the nozzle. Smaller nozzles produce smaller droplets than larger nozzles and Warren (1976) reports that the mean drop sizes of sprays produced by cone, fan or deflector (eg. flood-jet) nozzles were essentially the same if the fan or cone angles were about equal. Warren (1976) also reports that wider angle fan or cone nozzles produce smaller droplets than narrow angle nozzles. Round orifice nozzles (eg. jet) have also been shown to produce the largest droplet size for a given flow rate and pressure because there is less shear at the liquid-air interface. Raindrop[1] nozzles produced by Delavan Corporation have spray characteristics similar to hollow cone nozzles except that the raindrop nozzle has a chamber outside the metering orifice which helps to incorporate small satelite droplets, which might ordinarily produce drift, back into the larger droplets (Warren, 1976). In comparative tests the small RA Raindrop nozzle and the RD Raindrop nozzles reduced spray drift 6.5 times compared to flat-fan nozzles and 15.5 times compared to the D-1 flood nozzles (Klingman and Ashton, 1982). Performance of various nozzle types and their production of spray droplets under 100 microns in size are reported in Table 1.

The angle of the nozzles and spray boom can also affect the production of small droplets and drift. Angles above the horizontal should be avoided, since these tend to throw droplets upward. Likewise, offset nozzle types which also tend to propel droplets upward can also tend to increase drift (Dow, 1983).

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1 Trademark of Delavan Corporation

Droplet size is also affected by the pressure exerted at the nozzle tip. The lowest possible spray pressure that provides an adequate spray pattern should be used to minimize drift. Higher pressures cause droplet formation closer to the nozzle tip, with the formation of smaller droplets. At low pressure, however, the liquid escapes from the nozzle tip as a liquid film and droplets then form at the edge of the film (Klingman and Ashton, 1982).

Droplet size produced by a spray system can also be modified by the viscosity of the spray solution. As viscosity increases, the drop size of sprays increases which can reduce drift (Warren, 1976). There are several spray additives available which can increase the viscosity of the solution. One of these, Nalco-Trol,[1] a polyvinyl water soluble polymer, in addition to increasing viscosity has other viscoelastic properties that can also decrease fine droplets by capturing satelite droplets (Warren, 1976). A final factor affecting spray droplet size is humidity. As droplets fall through air, evaporation occurs reducing the size of the droplets. The process is accelerated in air with a low relative humidity versus air with high relative humidity.

The second major factor affecting spray drift is the amount of wind. Obviously, regardless of the size of a droplet, a strong wind can displace it from the intended site of application. Spray applications should be made if possible during periods when wind speeds are minimal. These periods of low wind speeds generally occur just before sunrise and around sunset. Of course it would not be practical for a lawn care applicator to make applications only during these times. In most states, lawn care applications are governed by the same regulations affecting agricultural applicators which specify that applications not be made in wind exceeding 10 miles per hour.

Another weather related factor which can affect drift is fog. Applications should not be made during periods of fog, since small droplets containing pesticides can dissolve in the water vapor in the fog and be moved great distances away from the application site before settling out.

The third major factor contributing to spray drift reported by Klingman and Ashton (1982) was the height at which the spray is released. The release height is important for two reasons. Firstly, the distance and therefore the time required for droplets to reach the ground, is directly affected. Secondly wind velocities are usually much lower close to the ground than at higher elevations (Klingman and Ashton, 1982). The effect of various factors on herbicide drift are summarized in table 2.

In commercial lawn care accounts, boom mounted spray systems are often used. However, in most applications of liquids made by lawn care companies a Chemlawn[2] gun is used. A ChemLawn gun operated to deliver a flow rate of 4 gallons per minute required a pressure of only 8 psi at the nozzle. The volume median diameter (VMD) produced by a ChemLawn gun exceeds 2,000 microns (Hurto, K. A. 1985 ChemLawn Corporation unpublished data), compared to a VMD

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1 Trademark of Nalco Chemical Company
2 Trademark of Chemlawn Corporation

of 590 microns for a RA Raindrop 5 nozzle and 220 microns for a flat-fan LF-5 nozzle (Table 1). The typical release height for a ChemLawn gun is approximately 3 feet above the turf and this combined with large droplets and low nozzle pressures should lessen the possibility for forming fine droplets and the potential for drift. An initial field study has been completed recently which examined the drift potential of a ChemLawn gun versus a typical boom mounted agricultural applicator. When the data are analyzed, they will indicate the drift potential of the ChemLawn gun agricultural system under identical weather conditions and will help us to better understand the potential for drift during lawn care applications.

LITERATURE CITED

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Table 1. Nozzle Performance at 40 psi and 5 mph

Type of Nozzle[1]	Flow (gpm)	Median Droplet Size (um)	Spacing (in.)	GPA	% Spray Volume Under 100 um
RA Raindrop* 2	0.20	330	40	5.9	1.0
RA Raindrop* 5	0.50	590	40	14.8	0.6
RD Raindrop* 1	0.18	310	20	10.7	1.0
RD RAINDROP* 2	0.29	410	20	17.2	0.8
Flat fan Spray LF-2	0.20	190	20	11.8	16.5
Flat fan Spray LF-5	0.50	220	20	29.8	13.0
Flooding D-1	0.20	200	40	5.9	15.5
Flooding D-2.5	0.50	235	40	14.8	11.5

From Klingman and Ashton (1982)

Table 2. Effect of Various Factors on Herbicide Drift

Less Drift	Factor	More Drift
Lower	A. Release Height	Higher
Lower	B. Wind Speed	Higher
Faster	C. Droplet Fall Rate	Slower
Larger	1. Droplet Size	Smaller
Lower	a. Pressure	Higher
Jet	b. Nozzle Type	Wide Angle cone or fan
Larger	c. Orifice Size	Smaller
Lower	d. Air Shear on Spray	Higher
Higher	e. Surface Tension	Lower
Higher	f. Relative Humidity	Lower
Higher	g. Viscosity	Lower

Adapted from Warren (1976)