GUEST EDITORIAL

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Developments in International Harmonization of Pesticide Drift Management

The off-target movement of agricultural chemicals has become a major issue in the USA, Europe and elsewhere. Spray drift is an important topic for applicators, regulators and registrants of agricultural chemicals. In the USA, EPA announced in the early 1980s a requirement for data on pesticide drift for the re-registration of existing pesticides and registration of future pesticides. The agricultural chemical industry completed its database development for this purpose at the turn of the millennium (9). The industry effort represented an extensive field and laboratory research effort by 40 pesticide registrants at a cost in excess of $21 million.

The EPA is working with industry, the U.S. Dept. of Agriculture (USDA) and Forest Service to develop drift modeling tools that will be essential for overhauling pesticide labels in the USA. The AgDRIFT® model for assessing drift exposure from aerial, hydraulic ground and orchard airblast spraying was recently expanded to include extensive forestry application tools (15). Other models are also available, such as gaussian plume (*e.g.* 14) and random walk (17) models, for predicting pesticide drift.

Current joint activities between the USA and Canada include developing a genetic algorithm for aerial spray application optimization (10). This kind of resource will allow the *total* spraying operation to be considered, rather than just the drift component, for effective decision-making prior to applications. This is important because changing application practices in order to reduce drift can have adverse effects on other aspects of spray performance and efficacy. For example, large droplet sizes are commonly regarded as a primary factor in reducing spray drift. While it is true that larger droplets tend to be less prone to drift than smaller droplets, some products are more effective when applied as relatively small droplets. Spray collection on different targets, and indeed on the upper and/or lower surface of targets such as leaves, is related in part to droplet size. Getting the droplets to the target, and ensuring that they provide uniform coverage on that target without bouncing or rolling off the foliage, can be a fine art requiring very careful optimization of droplet size and delivery systems. Although some products, such as many herbicides, are effective when applied as large droplets, many insecticides and fungicides become less effective when applied as relatively coarse sprays. An extreme example would be vector control, where aerosol-sized droplets are generally most effective at impacting insects in flight. The importance of droplet size on different components of the total spray decision-making process was discussed by me elsewhere (7). Twin-fluid air induction nozzles provide an increasingly popular method of reducing drift potential from ground spray applications by applying larger droplets without a necessary increase in application volume rates.

Another possible impact of moving to larger droplets for drift reduction is that spray volumes may need to be higher for the same level of control. Recognizing the importance of total product release rates, allowance is given in the UK for reducing buffer or ‘no spray’ zones by reducing dose rates. This is included in the *Local Environmental Risk Assessment for Pesticides*, or LERAP scheme, which was introduced in 1999 (5). LERAP includes several features that give credit for drift reduction measures in spray applications. Minimizing the size of ‘no spray’ zones is an important issue to a grower or applicator, since land that cannot be sprayed may represent lost production or areas for pests and diseases to survive for re-invasion of the field. The LERAP scheme allows users to reduce the size of ‘no spray’ zones by using sprays that have been approved as having different ratings for drift reduction as measured in the laboratory. This recognizes that droplet size is not the only nozzle output that can affect spray drift from ground applications.

Two sprays with the same droplet size distribution could have substantially different drift potentials if the droplets are moving at different speeds, have air inclusions or an electrostatic charge. Air-induction twin-fluid nozzles have become popular in Europe and some parts of North America. Some of these nozzles have been rated for drift reduction using the LERAP star-rating scheme.

Several countries are still finalizing their drift management schemes. Germany has developed its own extensive database on drift from ground and orchard spraying (4). There are many other data sets and models for spray application and drift research conducted in the field and laboratory around the world (*e.g.* 1,4,11,12,16). Most of the databases include conventional application techniques and reasonable worst-case conditions of application, meteorology and canopy/site characteristics. This is because regulators need to consider the reasonable worst-case drift that could occur from a given application. However, the appropriate use of the databases and models should carefully consider real-world application possibilities and encourage techniques that would reduce drift potential. Testing and classification systems for spraying systems offering as much as 50% to 90% drift reduction have recently been included in the drift regulatory process in Germany (2,3).

Faced with a need to reduce drift significantly from previous levels, some European countries have developed data on other drift reduction methods. While it is important to look at the spray released from a sprayer and the transport mechanisms toward the target (*e.g.* air-assistance, electrostatics, etc.), it is also important to consider spray interception by surfaces in the path of a moving spray. Data from the Netherlands and other countries have shown that drift can be reduced by 50% to 85% by using natural or artificial barriers (*e.g.* 6).

The successful evaluation of drift reduction measures using low drift nozzles, sprayers, natural and artificial barriers, drift control adjuvants or other techniques requires the provision of appropriate test methods. Recognizing that standards are needed for these types of characterizations, several societies are working together on a common testing approach. These include the American Society for Testing and Materials (ASTM), the International Standards Organization (ISO), the European Standards Organization CEN, and others. In 2000, these groups met and agreed to look into finalizing standards for testing spraying systems in the context of drift minimization and application optimization. Several standards already exist for spray measurement and classification, including a spray quality scheme that has been adopted in the USA for labeling plans and expanded in Europe to include drift potential (13). It is hoped that these efforts will advance the science of effective spray application for effective control of pests and diseases with minimal environmental contamination and product wastage. Measures to protect the environment need to consider carefully all available resources as well as possible impact on agricultural production (8).

The next few months and years will probably be exciting times for crop protection as the existing and new data and models provide information for the optimization of the many parts of the equation involved in safe and effective spray application.

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