SPRAY NOZZLES AND SPRAY DROPLET SIZE

Because pesticides differ in their requirements for coverage to be effective, spray droplet size is important. The following resources should be consulted for pertinent information that will guide you in choosing nozzles that will produce the appropriate droplet size to both control targeted pests and reduce drift when spraying pesticides.

The basic tenets associated with spray droplet size are:

- Minimizing drift and achieving adequate coverage are the two most important factors to consider when applying herbicides.
- An applied pesticide spray mixture is comprised of spray particles or droplets of various sizes.
- Spray droplet size has the most influence on the drift potential of an applied spray mix.
- When the size of spray droplets is reduced, their numbers increase.
- Managing the size of spray droplets is critical for both pesticide effectiveness and drift control.
- Generally, as spray particle size increases, spray coverage of targeted pests decreases, as does drift potential.
- For the most effective spray application, select nozzle types, tip sizes, and operating pressures that will produce particle sizes that are large enough to reduce risk of drift while also providing adequate coverage of the applied pesticide.
- Consult pesticide labels for specific nozzle types [if given] that should be used.

The below resources can be accessed for specific information on this subject. A brief summary of each resource's content is provided.

UTcrops News Blog [Univ. of Tenn.]. In this video, Dr. Larry Steckel and Garret Montgomery show Palmer amaranth control resulting from applying Liberty herbicide using various nozzle types. As they show, nozzles that produce finer droplets will result in the most control when using this herbicide.

"Understanding Droplet Size" [South Dakota Coop. Ext.]. Terms associated with droplet size are presented, along with their definitions and descriptions. A chart of color codes for various droplet sizes from "Extremely Fine" [<60 microns] to "Ultra Coarse" [>650 microns] is also included.

"Spray Droplet Size and Drift" [Kansas State andVirginia Tech Universities]. This resource [accessible from reference list] is an extensive slide set that contains graphic representations of how droplet size affects both coverage and drift potential of applied pesticides.

"Droplet Chart/Selection Guide" [Virginia Coop. Ext.]. A chart that provides a general guide for the droplet range to use for the application of fungicides, insecticides, and herbicides is included. The tabled values are to be used in the absence of specific guidance in the product label.

"Spray Tip Classification by Droplet Size" [ASAE S-572]. This standard defines droplet spectrum categories for the classification of spray tips. The purpose is to provide droplet size information primarily to indicate drift potential and secondarily to indicate application efficiency. The relative tip comparisons are based on droplet size only. Degrees of atomization are related to the size of droplets in types of precipitation and size of common objects. Particle size distributions at varying spray pressures are presented for the various nozzle types.

"Applicator's Guide to Spray Droplet Size, Drift, Nozzle Selection, and Spray Coverage" [Univ. of California Coop. Ext.]. Color-coded examples of the spray coverage provided by different types of drift-reducing nozzles at varying spray volumes are shown. A table of environmental and application conditions affecting drift is also included.

"Nozzles and Droplets: What Do the Colors Mean" [Arizona Coop. Ext.]. Two color schemes, one to represent flow rate and the other to represent droplet size, are used to guide pesticide applicators when selecting nozzles. The two schemes are independent of each other. The color of the spray nozzle tip describes the flow rate of the nozzle orifice at 40 psi. The second color scheme was developed to describe spray droplet sizes using the Volume Mean Diameter [VMD], which is the average droplet size in a spray [described in detail in the above references]. The authors state that sprayer calibration should begin with determining the proper droplet size for a given pesticide [usually included in the label], and then refer to nozzle tables to select the proper nozzle tip color to obtain that droplet size based on the intended operating pressure, sprayer travel speed, and spray volume.

"Nozzles: Selection and Sizing" [Virginia Coop. Ext.]. The content in this article covers nozzle descriptions and how common nozzle types should be used in agricultural applications. Presented information can be used to select the proper nozzle type to ensure correct application of pesticides and to control/mitigate drift.

"Spray Drift of Pesticides" [Univ. of Nebraska-Lincoln Ext.]. This publication is a detailed presentation of the conditions that cause spray particle drift, and the methods that can be used to reduce drift potential from sprayed pesticides. Of particular interest is the information in Table 1, which shows how droplet size affects rate of fall and lateral movement of particles. The authors present a detailed discussion of how droplet size can be altered by nozzle type, spray pressure, orifice size and carrier volume, nozzle spray angle, and spray volume. They also cover other drift factors such as boom height, nozzle spacing, wind speed, wind direction, air stability, and relative humidity and temperature.

Precise Spray Droplet Sizes for Optimizing Herbicide Applications [Univ. of Nebraska-Lincoln—Crop Watch]. This article presents results from using a Pulse Width Modulation [PWM] sprayer that can variably control flow to optimize spray droplet size throughout an application. Field trials were conducted in Nebraska to determine optimum spray droplet sizes for the herbicides Liberty, Clarity, Enlist Duo, Roundup WeatherMaxx plus Clarity, Ultra Blazer, and Cobra. Each of these herbicides was evaluated to determine efficacy against either Palmer amaranth or kochia that was 10 in. tall or greater. The herbicides were applied in either 5, 10, 15, or 20 gal./acre [gpa] using targeted droplet sizes of 150, 300, 450, 600, 750, and 900 µm. The results were used to determine the combination of gpa and droplet size that would provide the greatest efficacy and least drift potential of each of the above six herbicides.

Pesticide Application Technology Lab [Univ. of Nebraska-Lincoln]. This link goes to a brief description of the Univ. of Nebraska's laboratory that exists to support the safe and efficacious application of pesticides. The lab conducts research that is designed to provide results that will allow improved understanding of how to maximize efficacy of applied pesticides while minimizing unintended environmental effects such as drift. The research involves investigating how nozzle selection, spray solution, pressure, and sprayer modifications can be combined to do this.

There is some redundancy in the presentations cited above. However, as shown in the short summaries of each resource, each citation has some unique information that is important and pertinent to the subject of this article.

Thanks to Dr. Eric Prostko of the Univ. of Georgia for supplying links to many of the cited resources.

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