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Droplet Chart / Selection Guide

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When choosing nozzles/droplet sizes for spray applications, applicators must consider both coverage needed and drift potential. As a rule, smaller droplets provide better coverage, but larger droplets are less likely to drift.

Nozzle type and application pressure govern droplet size (see *Nozzles: Selection and Sizing*, Virginia Cooperative Extension publication 442-032), which in turn affects system output (application rate), target deposition, uniformity, efficacy, and the risk of drift. Off-target movement in the form of spray drift is a major concern because it diverts the chemical from the intended target, reduces efficacy, and deposits pesticide where it is not needed or wanted. When a pesticide drifts, it may cause both environmental and economic damage, including exposure to people and property, injury to susceptible vegetation, harm to wildlife, deposition of illegal residues on crops, and contamination of water supplies.

In some cases, increased droplet size may reduce efficacy. Although fine or very fine droplets (if applied uniformly) can, theoretically, provide the best coverage, small, lightweight droplets may not penetrate plant canopies. Droplets produced by air-induction nozzles may break vs. bounce when they hit the target, providing better coverage than droplet size rating alone would indicate. In many cases, choosing a nozzle/droplet size for a job is a tradeoff between good coverage and drift potential.

So ... what's an applicator to do?! Many labels provide recommendations and/or requirements regarding droplet size, nozzle selection, and sprayer configuration. Research in application technology supports recommendations in nozzle-selection guides and directions on product labels. However, in the absence of specific guidance, Charts 1 and 2 may serve as a starting point.

Chart 1. Droplet range for application/pest control[1].

Application	Droplet Category[2]	Approximate VMD Range[3] (in microns)
Fungicide		
foliar protective or curative	Medium (M)	226-325
Insecticide		
foliar contact or stomach poison	Medium (M)	226-325
foliar systemic	Coarse (C)	326-400
soil-applied systemic	Coarse (C)	326-400
	Very Coarse (VC)	401-500
	Extremely Coarse (XC)	500-650
	Ultra Coarse (UC)	>650
Herbicide		
foliar/post-emergent contact	Medium (M)	226-325
foliar/post-emergent systemic	Coarse (C)	326-400
soil-applied/pre-emergent systemic	Coarse (C)	326-400
	Very Coarse (VC)	401-500
	Extremely Coarse (XC)	501-650
	Ultra Coarse (UC)	>650

[1] Always read the label. Pesticide product labels may specify what droplet size to use, which will direct nozzle selection and, in turn, affect spraying equipment configuration and calibration.

[2] ASABE (American Society of Agricultural & Biological Engineers) Standard 572.1.

[3] Reported VMD ranges vary widely, based upon the type of laser analyzer used. VMD = Volume Median Diameter: a value where 50% of the total VOLUME or mass of liquid sprayed is made up of droplets LARGER than and 50% SMALLER than this value.

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Chart 2. Droplet size classification chart

Droplet Category[1]	Symbol	Color Code	Approximate VMD Range[2] (in microns)
Extremely Fine	XF	Purple	<60
Very Fine	VF	Red	60-145
Fine	F	Orange	145-225
Medium	M	Yellow	226-325
Coarse	C	Blue	326-400
Very Coarse	VC	Green	401-500
Extremely Coarse	XC	White	501-650
Ultra Coarse	UC	Black	>650

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Droplets, Coverage, and Drift:

Very fine droplets (VMD less than 145 microns) are collected efficiently by flying insects or needles on coniferous plants, but they tend to remain in the air stream, which carries them around the stems and leaves of weeds.

Fine and medium-size droplets (VMD between 145 and 325 microns) will deposit efficiently on stems and narrow vertical leaves such as grasses if applied when there is some air movement.

Coarse (or larger) droplets (VMD more than 325 microns) deposit efficiently on large, flat surfaces such as the leaves of broad-leaved weeds.

Insecticides, fungicides, and contact generally require smaller droplets (Chart 1) than systemic herbicides to obtain adequate coverage of the target. For foliar systemic herbicides, however, experimental results suggest that applications using droplet sizes in the course ranges do not significantly differ unless application volumes are extremely high or very low. (Exceptions may exist for specific herbicides.)

Summary:

1. When choosing a nozzle, consider both flow rate and droplet size.
2. Base decision on target and properties of active ingredient.
3. Avoid using nozzles and pressures that will produce a volume median diameter (VMD) of less than 225 microns (fine–very fine - extremely fine).
4. Always **read the label**. Pesticide product labels may specify what droplet size to use and how much finished spray mixture to apply to a given area. This will direct nozzle selection and, in turn, affect spraying equipment configuration and calibration.

References and Additional Information:

Strategies to Reduce Spray Drift, Kansas State University Agricultural Experiment Station and Cooperative Extension Service publication MF-2444; *http://www.ksre.ksu.edu/bookstore/pubs/MF2444.pdf.*

Fine Tuning a Sprayer with "Ounce" Calibration Method, VCE publication 442-453; http://*pubs.ext.vt.edu/442-453/.*

Protect Virginia's Sensitive Areas: Control Your Drops-and-Control Your Drift! Virginia Tech Pesticide Programs and Virginia Department of Agriculture and Consumer Services, Office of Pesticide Services; *http://vtpp.ext.vt.edu/pesticide-safety-education-program/control-your-drops.*

Nozzles: Selection and Sizing, VCE publication 442-032; http://*pubs.ext.vt.edu/442-032/*

Spray Nozzle Classification by Droplet Spectra, ANSI/ASAE Standard S572.1 w/correction March 2009 (R2013); American Society of Agricultural and Biological Engineers, St. Joseph, MI; *http://elibrary.asabe.org/standards.asp*

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