Sprays – The Basics and Tools You Can Use

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1. Spray Droplet Size – Understanding the Basics

2. Scale of Measurement - Micrometer

3. Droplet Diameter

4. A droplet of \( \frac{3}{4} D_1 \) is 1/8 the volume of \( D_1 \)

\[
\frac{V_1}{V_2} = \frac{0.75^3}{0.5^3} = \frac{1}{0.125} = 8 \]

5. Droplet Volume - 1000 µm drop

6. Droplet Volume - 8 - 200 µm drops
Droplet Size Definitions

- **D_{V0.5}** or Volume Median Diameter (VMD)
  - Droplet diameter at which 50% of the total spray volume is in droplets of smaller diameter
- **D_{V0.1}** and **D_{V0.9}**
  - Droplet diameters at which 10% and 90%, respectively of the total spray volume is in droplets of smaller diameter

4008 @ 30 psi and 130 mph – Herbicide Mix

Reference Nozzle Curves
Pesticide Labels = Law

Labels indicate requirements and limitations associated with the application of a particular product. Applicators must follow guidance provided on product labels:
- Application Method
- Nozzle types
- Spray rate
- Droplet Size
- Meteorological conditions
- Tank mix partners
- Number of applications
- Etc.

Example – RoundUp PowerMax

Controlling Droplet Size
- Maximum spray coverage rate reduces number of sprays needed to apply the larger droplets. The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if the application is made improperly, or under unfavorable environmental conditions, such as windy, high temperature with low humidity, and/or inversion conditions as described below.
Aerial Spray Pressure – Lower is Not Usually Better

Spray speed

Similar to 160 mph down to 140 mph
Example nozzle: VMD 275 \( \rightarrow \) 375 \( \mu \text{m} \)
Fines\(<100 \mu \text{m} \) 7.5\% \( \rightarrow \) 3.5\%

Airspeed

Spray speed

40 psi \(~\) 40 mph
120 psi \(~\) 60 mph
Similar to 160 mph down to 140 mph
Example nozzle: VMD 275 \( \rightarrow \) 375 \( \mu \text{m} \)
Fines\(<100 \mu \text{m} \) 7.5\% \( \rightarrow \) 3.5\%

Aerial Spray Models

• A set of droplet sizing models were developed by USDA ARS to assist applicators with this process.

http://tiny.cc/DropletSizeModels

• Detailed descriptions and instructions on website.

Example – RoundUp PowerMax

• Annual Weeds:
• Aerial: 3 – 5 gallons per acre
• Typical fixed-wing aircraft with the following operational characteristics:
• Typical application airspeeds - 130-150 mph
• 60-70' swath
• Based on label we will select nozzles and settings to achieve both a MEDIUM and a COARSE spray application.

Select nozzle type
Enter operational settings
Enter spray rate and swath width
Other Options – Number of Nozzles Fixed

Other Options – Pressure Fixed
• At equal volume:
  • Halving the diameter creates 8X droplets.
  • Quartering creates 64X droplets
  • The smaller the diameter, the greater the number of droplets, and the less control you have over them.
• Labels = Law … but there are some issues. Intent is reduced drift.
• Droplet Size Models are there to help you make sense of the science when setting up your system.