Revising the ASABE S-572 Droplet Standard and Its Practical Use

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Ignite® 280 SL HERBICIDE

A non-selective herbicide for post emergence broadcast use on canola, corn, cotton, and soybean, designated as LibertyLink®. Ignite 280 SL Herbicide may be used for weed control in non-LibertyLink® cotton when applied with a hooded sprayer in-crop. Ignite 280 SL Herbicide may also be applied as a broadcast burndown application before planting or prior to emergence of any conventional or transgenic variety of canola, corn, cotton, soybean or sugar beet.

ACTIVE INGREDIENT: Glufosinate-ammonium* .......................................................... 24.5%**

OTHER INGREDIENTS: ........................................................................................................ 75.5%

*CAS Number 77182-82-2
**Equivalent to 2.34 pounds of active ingredient per U.S. gallon.

TOTAL 100.00%

EPA Reg No. 264-829
EPA Est. No. 264-MI-001
EPA Est. No. 407-IA-2

**Ground Application**: Ignite 280 SL Herbicide should be applied broadcast in a minimum of 15 gallons of water per acre. Under dense weed/crop canopies, 20 to 40 gallons of water per acre should be used so that thorough spray coverage will be obtained. Apply Ignite 280 SL Herbicide using nozzles and pressures that generate MEDIUM (about 250 to 350 microns) spray droplets category as reported by the nozzle manufacturer and in accordance to ASABE S 572. Do not use nozzles and pressures that result in COARSE sprays. FINE sprays should also be avoided to minimize spray drift risk. Boom height should be based on nozzle manufacturer recommendations. See the Spray Drift Management section of this label for additional information on proper application of Ignite 280 SL Herbicide.

**Aerial Application**: Poor coverage will result in reduced weed control. For optimal weed control, apply Ignite 280 SL Herbicide in a minimum of 10 gallons per acre. Apply Ignite 280 SL Herbicide using nozzles and pressures that generate MEDIUM (about 300 to 400 microns) spray droplets category as reported by the nozzle manufacturer and in accordance to ASABE S 572 based upon the selected air speed. Do not use nozzles and pressures that result in COARSE sprays. FINE sprays should also be avoided to minimize spray drift risk. See the Spray Drift Management section of this label for additional information on proper application of Ignite 280 SL Herbicide.
Nozzle Technology......

• Nozzles designed to reduce drift
• Improved drop size control
• Emphasis on ‘Spray Quality’
Nozzle Efficacy/Drift Slope

1980

Extended Range

Nozzle development timeline

Chamber Design

XR, TR

Turbo Flood

Turbo TeeJet

Air Mix

AI XR

GuardianAir

Venturi Design - II

2009

Venturi Design - I

Efficacy

Reducing Spray Drift

AI

Ultra Low Drift

Turbo Drop

TTI
Droplet Size Classification for Agricultural Sprays

• Safe and efficient application requires a definition of an appropriate droplet size spectrum:
  – Maximize spray efficiency for transporting crop protection product to the target.
  – Minimize off-target losses via:
    • Spray drift
    • Applicator exposure

• Spray performance and drift minimization depends on droplet size.

• Because of a multitude of nozzle types - sprays should be classified according to droplet size.
Origin Of Standardized Spray Droplet Size Categories - Europe

• 1985 – British Crop Protection Council (BCPC)
  – Spray classification system
    • Primarily designed to enhance efficacy
    • Originally for nozzles for ground spray applications
    • Other atomizers also included
  – Uses the term SPRAY QUALITY for droplet size categories.

• Quality of spray placed in five categories:
  – very fine, fine, medium, coarse, very coarse

• Recognized that droplet size spectra was different when measured by different instruments and techniques.
  – Laser diffraction, optical imaging, phase-Doppler
  – Sampling techniques with instrumentation
Origin Of Standardized Spray Droplet Size Categories – United States

• 1999 – ASAE Standard S572 (revised 2009-S572.1)
  – Defines droplet spectrum categories for the classification of spray nozzles.
  – Classified relative to specified reference nozzles discharging spray into static air so that no stream of air enhances atomization.
  – Droplet size classifications are primarily designed to indicate off-site spray drift potential.
  – Secondarily used for application efficacy.

• Standard is a means for relative nozzle comparisons only based on droplet size.
  – Does not address droplet trajectory, height, and velocity; air bubble inclusion; droplet evaporation; and impaction of target.
ASABE S-572.1 Droplet Size Standard
 WHAT'S NEW

ASABE 2010 AE50 winners announced at AETC and Ag Connect. Enjoy the YouTube video.

TMDL 2010—Abstract deadline extended to February 15.

Sixteen named to the 2010 class of "New Faces of ASABE."

Executive officer search in progress.

Candidates announced for 2010 Society elections.

Students! Check out the Engineers Week Video Competition.

New monograph—Livestock Energetics and Thermal Environment Management.

We’re growing! Help us welcome the following new members to ASABE.

MEETINGS


9th International Drainage Symposium, Quebec City, Canada, June 13-16, 2010

2010 ASABE Annual International Meeting, Pittsburgh, Pennsylvania, June 20-23, 2010
Spray Nozzle Classification by Droplet Spectra

- Liquid flow rate, liquid pressure, and physical changes to nozzle geometry and operation can affect the nozzle classification.
  - Nozzle can be classified into multiple categories.
  - Would depend on flow rate, operating pressure, etc.
- Based on spraying water through a reference nozzle compared to the nozzle being classified.
- Spray liquid properties may affect droplet sizes
  - Consider using surfactant-water mixtures
  - Always consider the ‘finer’ classification if comparing water and water with surfactant mixes.
ASAE Reference Nozzle and DSC for a Selected Nozzle Operation = Medium

The Red Curve Shows Data for the Selected Nozzle Operation. The Other Curves are for the ASAE S572 AUG99 Reference Nozzles.

Source: Buddy Kirk
<table>
<thead>
<tr>
<th>Category (symbol)</th>
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3.5 Classification category thresholds, nozzle spray angles, nominal rated flow ratings at 276 kPa (40 psi), reference flow ratings, and reference operating pressures are shown in Table 1.

<table>
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<th>Classification category threshold</th>
<th>Nozzle spray angle (°)</th>
<th>Nominal rated flow rate(^1) (L/min)</th>
<th>(gpm)</th>
<th>Reference flow rate(^2) (L/min)</th>
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<th>Reference operating pressure(^3) (kPa)</th>
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\(^1\)Nominal rated flow rate is at 276 kPa (40 psi) and is for nozzle size confirmation only; for IP-16 nominal rating is 0.75L/min at 6895 kPa (1000psi).

\(^2\)Reference flow rate is the actual rate used and has a tolerance of ±0.04 L/min (±0.01 gpm). Reference flow rate was determined for this Standard from \(Q=k\sqrt{P}\). The orifice coefficient (\(k\)) for each single, elliptical orifice reference nozzle is calculated from the nominal rated condition. IP-16 data is from the manufacturer MeeFog™. The reference operating pressure (\(P\)) is listed in the above table. Tolerances for the reference operating pressure are described in the following footnote.

\(^3\)Reference operating pressure is the hydraulic pressure used to obtain the reference flow rate and should be within a tolerance range of ±3.4 kPa (±0.5 psi) of the value tabled above. If the tolerance reference flow rate at the tolerance reference operating pressure cannot simultaneously be achieved, a different nozzle tip should be selected. All pressures are measured with a test gage with a minimum accuracy of 2 kPa (0.25 psi) (accuracy grade =3A). Test pressure is obtained via a capillary tube connected to a tee that accommodates the nozzle body to minimize flow restrictions and potential pressure drop between the capillary and nozzle tip. No nozzle strainer is present in the nozzle body.

\(^4\)IP-16 is a pin deflector fog nozzle from MeeFog™.
Droplet Sizing

• Measured with a laser-based instrument.
  – Both reference and nozzles to be classified
• Commercial droplet sizing instruments typically use techniques with:
  – Laser diffraction
  – Laser imaging
  – Laser-based phase Doppler
• Verification and calibration to known standards essential.
• Nozzle oriented to scan the entire spray plume.
• Ensure a representative cross-sectional sample of the spray plume is obtained.
Droplet Sizing

- Determine a reference graph from the reference nozzles.
- Create example reference graph by plotting droplet diameter (microns - µm) vs. the cumulative spray volume (fraction or %).
- Curves will define the classification thresholds between categories.
Figure 1 – Sample reference graph developed from measurements averaged from three types of laser instruments. NOTE: To view figure in color please go to http://www.asabe.org/standards/images/s572images.html
5.3 Droplet spectra measurements for (A) reference nozzles and (B) nozzles to be classified shall be performed with the same (1) instrument, (2) measurement method, (3) sampling technique, (4) scanning technique, (5) operator; and (6) similar environmental condition. Any deviation in these six factors may void the accuracy of the classification. The reference graph shall be verified before and after measurements are taken to classify nozzles. The frequency of graph verification should ensure that repeatable classification results are obtained throughout testing.
Practical Uses for S-572.1

• Manufacturers can have their nozzles tested by a qualified technician using the proper equipment and techniques as outlined in S-572.1.

• Manufactures can do in-house testing provided they follow the specifications outlined in S-572.1.
How can the applicators use this standard for day to day applications?
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## XR TeeJet® (XR) and XRC TeeJet® (XRC)

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## Turbo TeeJet® (TT) and Turbo TeeJet® Duo (QJ90-2TT)

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## Ai TeeJet® (Al) and AIC TeeJet® (AIC)

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Hypro – GuardianAir Induction

- More consistent droplet
- All-in-one cap and screen
- Wide angle with 15 degree incline toward the rear
- Aim forward or rearward – alternate?

See Page 16, Hypro Spray Tip Guide
Greenleaf Droplet chart:

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**CP® Floater/Sprayer Nozzle Droplet Key**

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<td>≤377.8μm</td>
<td>≤700.12μm</td>
</tr>
<tr>
<td>Very Coarse (VC)</td>
<td></td>
<td>≤129.22μm</td>
<td>≤434.9μm</td>
<td>≤1000.2μm</td>
</tr>
<tr>
<td>Extremely Coarse (XC)</td>
<td></td>
<td>≥129.22μm</td>
<td>≥434.9μm</td>
<td>≥1000.2μm</td>
</tr>
</tbody>
</table>

**CP® 65-T-S Standard Sprayer Turbo Nozzle**

| Orifice | PSI   | #3 | #3 | #3 | #7.5 | #7.5 | #10 | #10 | #10 | #10 | #10 | #10 |
|---------|-------|----|----|----|------|------|-----|-----|-----|-----|-----|-----|-----|
| 30      | Xc    | Xc | Xc | Xc | Xc   | Xc   | Xc  | Xc  | Xc  | Xc  | Xc  | Xc  | Xc  |
| 40      | Xc    | Xc | Xc | Xc | Xc   | Xc   | C   | VC  | Xc  | C   | VC  | Xc  | Xc  |
| 50      | Xc    | Xc | Xc | Xc | Xc   | Xc   | C   | VC  | Xc  | C   | VC  | Xc  | Xc  |
| 60      | Xc    | Xc | Xc | Xc | Xc   | Xc   | C   | VC  | Xc  | C   | VC  | Xc  | Xc  |
Some of the featured areas of our web site to help you make spraying safer, easier and more effective.

**Tip Wizard** - An easy to use on-line computerized spray tip selector that helps you select the spray tip that is right for your application.

**COMBO-JET® Tip Caps** - Here you'll find COMBO-JET® all-in-one Tip-Cap & Strainer, the product that has become the new industry standard for it's ease of use.

**Tipology** - Easy to read and use information on spray application. Application rates, droplet size, drift control...and more.

**Featured Products** - This section has our latest innovations and featured products.

**Downloads** - Product literature, nozzle performance charts, price lists, it's all here and easy to print.
Calibration!!!!

The next phase!

A new concept for applicators!

Ensuring that the spray droplet spectrum is what it is supposed to be to maximize efficacy while minimizing drift!
Selecting the proper nozzle....

- Calculate GPM (formula)
- Look under GPM column
- Match to pressure-psi
- Choose the size needed
- Operate at given pressure and speed used in formula to achieve GPA

<table>
<thead>
<tr>
<th>Tip No. (Strainer Screen Size)</th>
<th>Liquid Pressure in psi</th>
<th>Capacity 1 Nozzle in GPM</th>
<th>Gallons Per Acre - 20” Spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIXR110015 (100 Mesh) Green</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 XC</td>
<td>12</td>
<td>8.9</td>
<td>7.1 5.9</td>
</tr>
<tr>
<td>20 XC</td>
<td>14.4</td>
<td>10.4</td>
<td>8.3 6.9</td>
</tr>
<tr>
<td>30 VC</td>
<td>17.8</td>
<td>12.6</td>
<td>10.1 8.4</td>
</tr>
<tr>
<td>40 VC</td>
<td>21</td>
<td>14.9</td>
<td>11.9 9.9</td>
</tr>
<tr>
<td>50 VC</td>
<td>24</td>
<td>17</td>
<td>14.2 12.2</td>
</tr>
<tr>
<td>60 VC</td>
<td>27</td>
<td>19.3</td>
<td>16.6 14.7</td>
</tr>
<tr>
<td>75 VC</td>
<td>30</td>
<td>21.6</td>
<td>19.1 17.3</td>
</tr>
<tr>
<td>90 VC</td>
<td>33</td>
<td>24.1</td>
<td>21.6 19.3</td>
</tr>
</tbody>
</table>

| AIXR110025 (50 Mesh) Yellow   |                        |                           |                                 |
| 15 XC                         | 13                   | 11.1                      | 9.1 7.1                         |
| 20 XC                         | 15.6                 | 13.4                      | 11.6 9.6                        |
| 30 VC                         | 18.3                 | 16.3                      | 14.3 12.3                       |
| 40 VC                         | 21                   | 19.3                      | 17.3 15.3                       |
| 50 VC                         | 23.8                 | 22.3                      | 20.4 18.4                       |
| 60 VC                         | 26.5                 | 25.3                      | 23.5 21.5                       |
| 75 VC                         | 29.2                 | 28.2                      | 26.2 24.2                       |
| 90 VC                         | 31.9                 | 31.1                      | 29.1 27.1                       |

| AIXR11003 (50 Mesh) Blue      |                        |                           |                                 |
| 15 XC                         | 18                   | 13.4                      | 11.4 9.4                         |
| 20 XC                         | 21                   | 15.6                      | 13.6 11.6                        |
| 30 VC                         | 24                   | 17.8                      | 15.8 13.8                        |
| 40 VC                         | 27                   | 20                       | 18.2 16.2                       |
| 50 VC                         | 30                   | 22.4                      | 20.4 18.4                       |
| 60 VC                         | 33                   | 24.6                      | 22.6 20.6                       |
| 75 VC                         | 36                   | 26.8                      | 25 23.8                         |
| 90 VC                         | 39                   | 29                      | 27 25                         |

| AIXR11004 (50 Mesh) Red       |                        |                           |                                 |
| 15 XC                         | 24                   | 17.8                      | 15.8 13.8                       |
| 20 XC                         | 27                   | 20.1                      | 18.1 16.1                       |
| 30 VC                         | 30                   | 22.4                      | 20.4 18.4                       |
| 40 VC                         | 33                   | 24.6                      | 22.6 20.6                       |
| 50 VC                         | 36                   | 26.8                      | 25 23.8                         |
| 60 VC                         | 39                   | 29                      | 27 25                         |
| 75 VC                         | 42                   | 31.2                     | 29.2 27.2                       |
Droplet Size Calibration: A New Approach to Effective Spraying

Proper calibration of a sprayer is essential for accurate, safe, and efficient application of crop protection products. The calibration process ensures that the intended amount of spray material is being applied, ensuring compliance with federal and state regulations.

The key steps in the calibration process involve:
1. Determining the desired application volume (DAV).
2. Selecting the correct droplet size distribution.
3. Adjusting the sprayer to deliver the correct droplet size distribution.

The first step in calibration is to determine the desired application volume (DAV). This is typically specified by the crop protection product manufacturer and is based on the application rate and the area to be treated.

Table 1: Application rates for selected crops and pest management practices.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Application Rate (gpa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>27.5</td>
</tr>
<tr>
<td>Soybeans</td>
<td>22.5</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>30.0</td>
</tr>
</tbody>
</table>

Once the DAV is determined, the next step is to select the correct droplet size distribution. This is done by matching the droplet size distribution of the sprayer to the specifications of the crop protection product. The droplet size distribution is typically specified as a range of droplet sizes, with the most common being the 10th and 90th percentiles.

Table 2: Droplet size distribution for selected applications.

<table>
<thead>
<tr>
<th>Application</th>
<th>10th Percentile</th>
<th>90th Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn management</td>
<td>200</td>
<td>600</td>
</tr>
<tr>
<td>Soybean management</td>
<td>150</td>
<td>500</td>
</tr>
<tr>
<td>Alfalfa management</td>
<td>250</td>
<td>750</td>
</tr>
</tbody>
</table>

After selecting the correct droplet size distribution, the final step is to adjust the sprayer to deliver the correct droplet size distribution. This is typically done by adjusting the nozzle orifice size and the pressure of the spray system.

Table 3: Sprayer adjustment settings for selected applications.

<table>
<thead>
<tr>
<th>Application</th>
<th>Nozzle Orifice Size</th>
<th>Pressure Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn management</td>
<td>0.030</td>
<td>80 psi</td>
</tr>
<tr>
<td>Soybean management</td>
<td>0.025</td>
<td>75 psi</td>
</tr>
<tr>
<td>Alfalfa management</td>
<td>0.035</td>
<td>90 psi</td>
</tr>
</tbody>
</table>

Correct calibration of the sprayer is crucial for effective and efficient application of crop protection products. By following these steps, growers can ensure that the intended amount of spray material is being applied, resulting in effective pest control and optimized use of crop protection products.
Droplet Characteristics Solutions - Sympatec Laser - College Station
CP11TT4015 Flat-Fan

140 MPH
40 PSI
23 degree orientation
ASC D-12 Rotary Atomizer

140 MPH
26 PSI
2 GPA
Blade pitch #2
Droplet Characteristics
Water
Oxford Laser Wooster
Droplet Characteristics
Water Sensitive & Kromekote
Paper – KSU
Droplet Characteristics – Spread Factors – Solutions College Station
Disclaimer:

• Brand names appearing in this presentation are for identification and illustration purposes only.

• No endorsement is intended, nor is criticism implied of similar products not mentioned.