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

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Biological and Agricultural Engineering



















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 TOTAL 100.00%

**Equivalent to 2.34 pounds of active ingredient per U.S. gallon.

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.

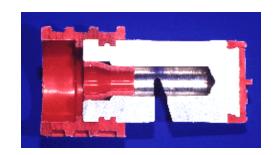
Aerial Application: Poor coverage will result in reduced weed control. For optimal weed control, apply Ignite 280 SL Herbicide in a minimum of 10 gallons per acre. Apply Ignite 280 SL Herbicide using nozzles and pressures that generate MEDIUM (about 300 to 400 microns) spray droplets category as reported 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'















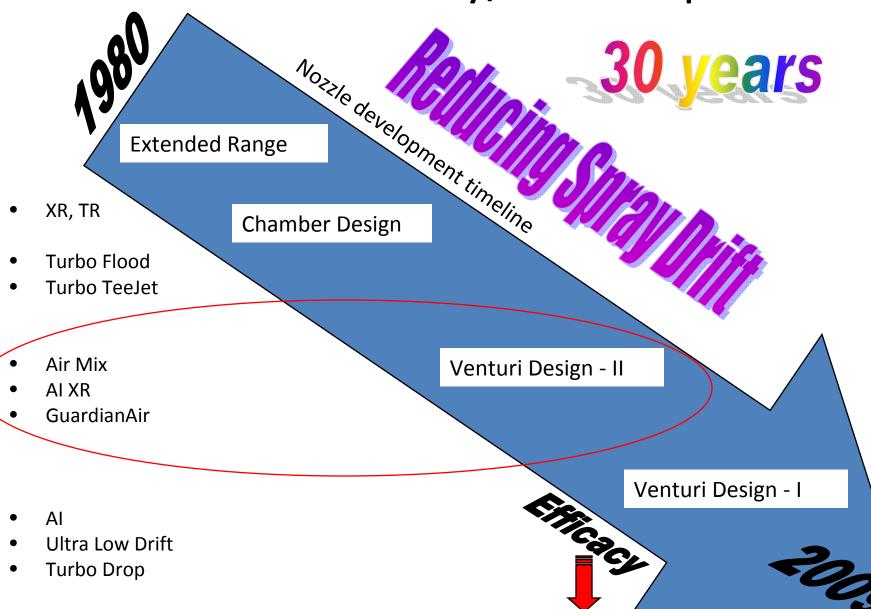








Nozzle Efficacy/Drift Slope



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 <u>SPRAY QUALITY</u> 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.

ANSI/ASAE \$572.1 MAR2009 Spray Nozzie Classification by Droplet Spectral



American Society of Agricultural and Biological Engineers

oplet Size Standard ASABIE is a professional and technical organization, of members worldwide: enoingering applicable to apribultural, lood, and biological systems daysloced and adopted by the American Society of April needs within the sciope of the Boolety; principals and water resource management, turi v electris power applications. 🙌

weining Practices, and Date. Conformity does not ensure ... and régulations. Prospective users are responsible for protecting

ASABE S-57 Engineering Practices, and Data Initially approved prior to the socially name change in July of asignated of "ABAE", regardless of the revision approval data. Newly developed Standards, Engineering radilices and Data approved after July of 2005 are designified as WSABET

Standards designated as 'ANSI' are American National Standards as are all ISO adoptions published by ASASE. Adjection as an American National Standard requires vertication by ANSI that the requirements for due process. consensus, and other ofiteria for approval have been met by ASAEE.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substended agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerned effort be made forward their resolution.

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21st Century Watershed Technology: Improving Water Quality and the Environment, Earth University, Costa Rica, February 21-24, 2010

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

2010 ASABE Annual International Meeting, Pittsburgh, Pennsylvania, June 20-23, 2010

SPOTLIGHT



Take Five! Spend a few moments with ASABE member Robert Large



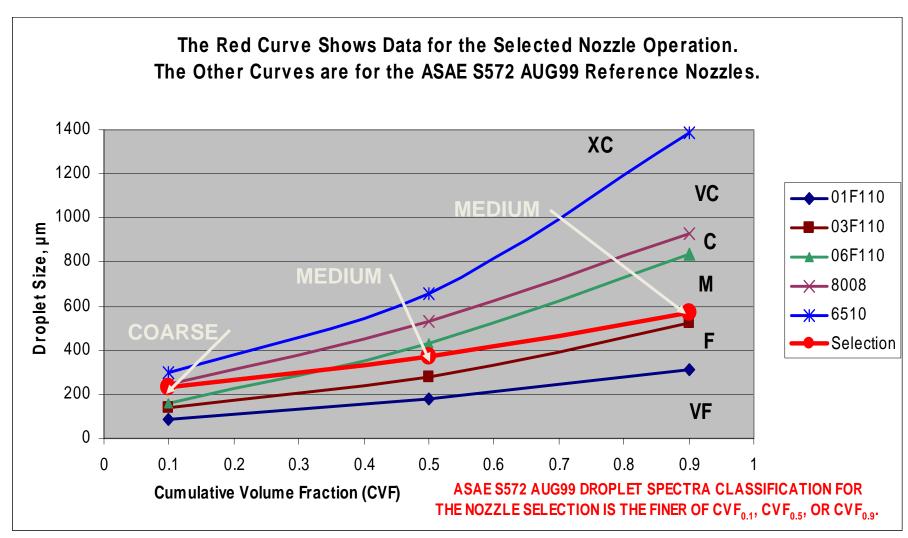




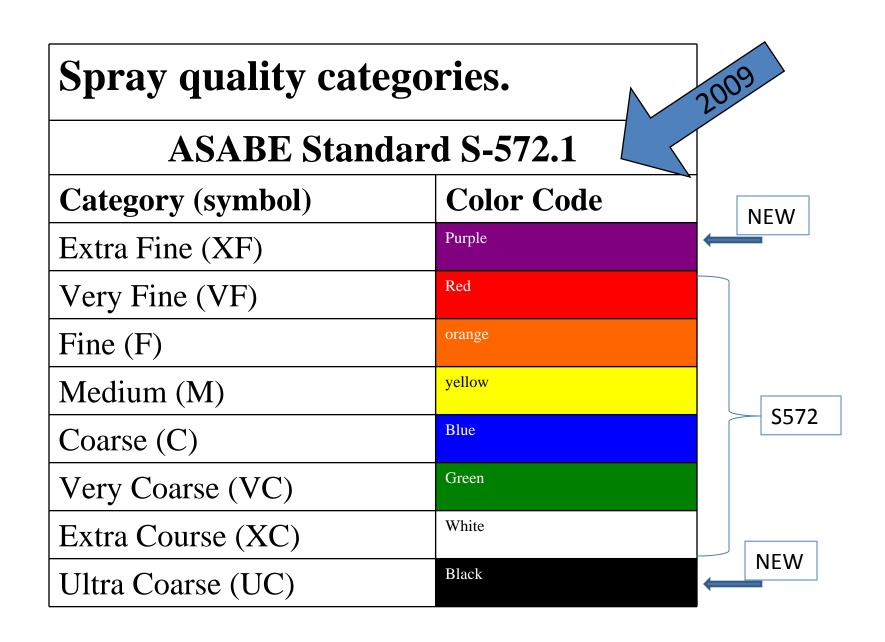
Spray Nozzle Classification by Droplet Spectra

- 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



Source: Buddy Kirk



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 1 – Classification category threshold values for flat spray nozzles

Classification	Nozzle	Non rated flo	ninal ow rate ¹	Reference	flow rate ²	Reference operating pressure ³		
category threshold	spray angle (°)	(L/min)	(gpm)	(L/min)	(gpm)	(kPa)	(psi)	
XF / VF	IP-16 ⁴ , 30	0.075	0.032	0.036	0.010	550	79.8	
VF / F	110	0.38	0.10	0.48	0.13	450	65.3	
F/M	110	1.14	0.30	1.18	0.31	300	43.5	
M / C	110	2.27	0.60	1.93	0.51	200	29.0	
C / VC	80	3.03	0.80	2.88	0.76	250	36.3	
VC / XC	65	3.78	1.00	3.22	0.85	200	29.0	
XC / UC	65	5.68	1.50	4.92	1.30	150	21.7	

¹Nominal rated flow rate is at 276 kPa (40 psi) and is for nozzle size confirmation only; for IP-16 nominal rating is 0.75L/m at 6895 kPa (1000psi).
²Reference 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√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.

⁴IP-16 is a pin deflector fog nozzle from MeeFog™.

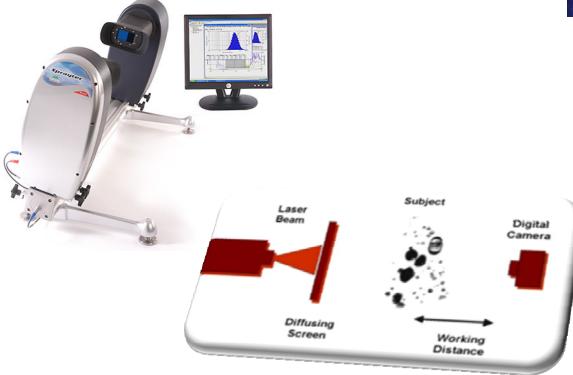
³Reference operating pressure is the hydraulic pressure used to obtain the reference flow rate and should be within a tolerance range of ±3.4 kPa (±0.5 psi) of the value tabled above. If the tolerance reference flow rate at the tolerance reference operating pressure cannot simultaneously be achieved, 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.

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.





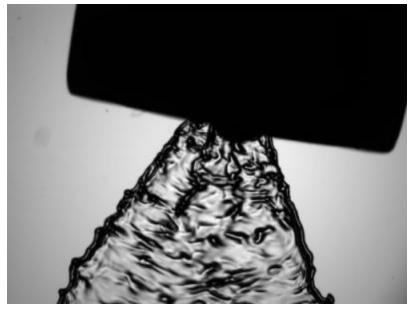












Droplet Sizing

- Determine a reference graph from the reference nozzles.
- Create example reference graph by plotting droplet diameter (microns μ m) vs. the cumulative spray volume (fraction or %).
- Curves will define the classification thresholds between categories.

Example Reference Graph

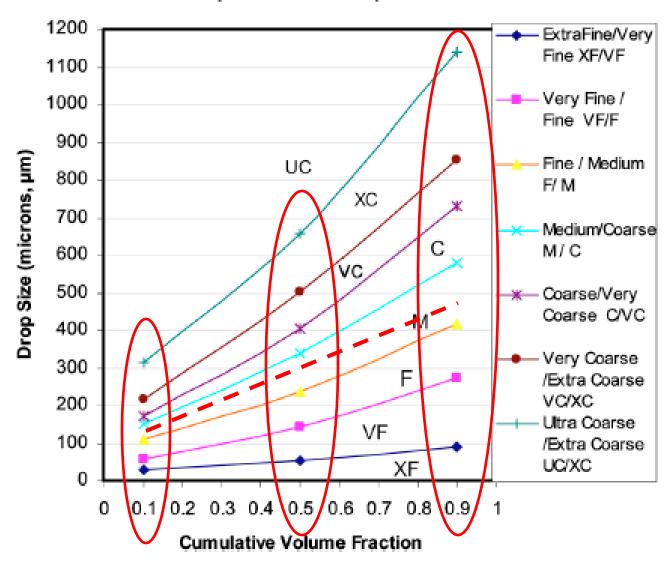


Figure 1 – Sample reference graph developed from measurements averaged from three types of laser instruments. NOTE: To view figure in color please go to http://www.asabe.org/standards/images/s572images.html

Standard says:

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?





Ignite® 280 SL HERBICIDE

A non-selective herbicide for post emergence broadcast use on ca Do not use nozzles and pressures that result in COARSE sprays designated as LibertyLink®. Ignite 280 SL Herbicide may Generate MEDIUM spray droplets (ASABE S-572)

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.

XR TeeJet® (XR) and XRC TeeJet® (XRC)

AΝ				PSI			
8	15	20	25	30	40	50	60
XR8001	M	F	F	F	F	F	F
XR80015	M	M	М	F	F	F	F
XR8002	M	M	М	М	F	F	F
XR8003	M	M	М	М	M	M	F
XR8004	С	C	М	М	M	M	М
XR8005	С	C	C	С	M	M	М
XR8006	С	С	C	С	U	C	U
XR8008	VC	VC	VC	С	U	C	U
XR11001	F	F	F	F	F	VF	VF
XR110015	F	F	F	F	F	F	F
XR11002	M	F	F	F	F	F	F
XR110025	M	M	F	F	F	F	F
XR11003	M	M	М	F	F	F	F
XR11004	M	M	М	М	M	F	F
XR11005	M	M	М	М	M	M	F
XR11006	С	С	М	М	M	M	М
XR11008	С	С	С	С	С	M	M

AIXR TeeJet® (AIXR)

	PSI										
	15	20	25	30	35	40	50	60	70	80	90
AIXR110015	XC	XC	VC	C	C	U	C	M	М	М	М
AIXR11002	XC	XC	XC	VC	VC	U	С	C	C	М	М
AIXR110025	XC	XC	XC	XC	VC	VC	С	C	C	U	С
AIXR11003	XC	XC	XC	XC	VC	VC	С	C	C	C	С
AIXR11004	XC	XC	XC	XC	XC	XC	VC	VC	C	C	С
AIXR11005	XC	XC	XC	XC	XC	XC	VC	VC	C	C	C
AIXR11006	XC	XC	XC	XC	XC	XC	VC	VC	VC	U	С

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

		(,,										
						PSI						
	15	20	25	30	35	40	50	60	70	80	90	
TT11001 QJ90-2XTT11001	C	М	М	М	М	M	F	F	F	F	F	
TT110015 QJ90-2XTT110015	U	U	М	М	М	М	М	М	F	F	F	
TT11002 QJ90-2XTT11002	U	U	U	М	М	М	М	М	М	М	щ	
TT110025 QJ90-2XTT110025	VC	C	U	U	М	М	M	М	М	М	F	
TT11003 QJ90-2XTT11003	VC	VC	U	U	С	U	М	М	М	М	М	
TT11004 QJ90-2XTT11004	XC	VC	VC	U	С	С	С	U	М	M	М	
TT11005 QJ90-2XTT11005	XC	VC	VC	VC	VC	С	С	C	U	М	М	
TT11006 QJ90-2XTT11006	XC	XC	VC	VC	VC	С	С	U	C	С	М	
TT11008 QJ90-2XTT11008	XC	XC	VC	vc	VC	VC	С	U	U	С	М	

AI TeeJet® (AI) and AIC TeeJet® (AIC)

E		PSI											
٤	30	35	40	45	50	55	60	70	80	90	100	115	
Al110015	VC	VC	VC	VC	VC	С	С	С	C	С	С	С	
Al11002	VC	VC	VC	VC	VC	VC	VC	С	C	С	C	C	
Al110025	VC	VC	VC	VC	VC	VC	VC	VC	С	С	С	С	
Al11003	ХC	XC	VC	С	O	С							
Al11004	ХC	XC	XC	VC	VC	VC	VC	VC	VC	С	С	С	
Al11005	ХC	XC	XC	VC	С	С							
Al11006	хс	XC	XC	ХC	VC	VC	VC	VC	VC	VC	С	С	
Al11008	ХC	XC	XC	ХC	XC	VC	VC	VC	VC	VC	VC	С	
Al11010	ХC	XC	XC	ХC	XC	VC	VC	VC	VC	VC	VC	С	

			\													
	(5)	DROP	CAPACITY ON E	CAPACITY					2		0″	_				
國(PSI	SIZE	N OZZLE IN GPM	NOZZLE -				G	PA				GALL(ONS PER	1000 S	Q. FT.
			III GFM	OZ/MIN.	4 MPH	5 MPH	6 MPH	8 MPH	10 MPH	12 MPH	15 MPH	20 MPH	2 MPH	3 MPH	4 MPH	5 MPH
TT11001 (100)	15 20 30 40 50 60 75 90	M M M F F	0.061 0.071 0.087 0.10 0.11 0.12 0.14 0.15	7.8 9.1 11 13 14 15 18	4.5 5.3 6.5 7.4 8.2 8.9 10.4 11.1	3.6 4.2 5.2 5.9 6.5 7.1 8.3 8.9	3.0 3.5 4.3 5.0 5.4 5.9 6.9 7.4	2.3 2.6 3.2 3.7 4.1 4.5 5.2 5.6	1.8 2.1 2.6 3.0 3.3 3.6 4.2 4.5	1.5 1.8 2.2 2.5 2.7 3.0 3.5 3.7	1.2 1.4 1.7 2.0 2.2 2.4 2.8 3.0	0.91 1.1 1.3 1.5 1.6 1.8 2.1 2.2	021 024 030 034 037 041 048 051	0.14 0.16 0.20 0.23 0.25 0.27 0.32 0.34	0.10 0.12 0.15 0.17 0.19 0.20 0.24 0.26	0.08 0.10 0.12 0.14 0.15 0.16 0.19
TT110015 (100)	15 20 30 40 50 60 75 90	M M M M F	0.092 0.11 0.13 0.15 0.17 0.18 0.21 0.23	12 14 17 19 22 23 27 29	68 82 9.7 11.1 12.6 13.4 15.6 17.1	5.5 6.5 7.7 8.9 10.1 10.7 12.5 13.7	4.6 5.4 6.4 7.4 8.4 8.9 10.4 11.4	3.4 4.1 4.8 5.6 6.3 6.7 7.8 8.5	2.7 3.3 3.9 4.5 5.0 5.3 6.2 6.8	2.3 2.7 3.2 3.7 4.2 4.5 5.2 5.7	1.8 2.2 2.6 3.0 3.4 3.6 4.2 4.6	1.4 1.6 1.9 2.2 2.5 2.7 3.1 3.4	0.31 0.37 0.44 0.51 0.58 0.61 0.71 0.78	0.21 0.25 0.29 0.34 0.39 0.41 0.48 0.52	0.16 0.19 0.22 0.26 0.29 0.31 0.36 0.39	0.13 0.15 0.18 0.20 0.23 0.24 0.29 0.31
TT11002 (50)	15 20 30 40 50 60 75	M M M M	0.12 0.14 0.17 0.20 0.22 0.24 0.27 0.30	15 18 22 26 28 31 35 38	8.9 10.4 12.6 14.9 16.3 17.8 20 22	7.1 8.3 10.1 11.9 13.1 14.3 16.0 17.8	5.9 6.9 8.4 9.9 10.9 11.9 13.4 14.9	4.5 5.2 6.3 7.4 8.2 8.9 10.0 11.1	3.6 4.2 5.0 5.9 6.5 7.1 8.0 8.9	3.0 3.5 4.2 5.0 5.4 5.9 6.7 7.4	2.4 2.8 3.4 4.0 4.4 4.8 5.3 5.9	1.8 2.1 2.5 3.0 3.3 3.6 4.0 4.5	0.41 0.48 0.58 0.68 0.75 0.82 0.92 1.0	0.27 0.32 0.39 0.45 0.50 0.54 0.61 0.68	0.20 0.24 0.29 0.34 0.37 0.41 0.46 0.51	0.16 0.19 0.23 0.27 0.30 0.33 0.37 0.41
TT110025 (50)	15 20 30 40 50 60 75	VC M M M M	0.15 0.18 0.22 0.25 0.28 0.31 0.34 0.38	19 23 28 32 36 40 44 49	11.1 13.4 16.3 18.6 21 23 25 28	8.9 10.7 13.1 14.9 16.6 18.4 20 23	7.4 8.9 10.9 12.4 13.9 15.3 16.8 18.8	5.6 6.7 8.2 9.3 10.4 11.5 12.6 14.1	4.5 5.3 6.5 7.4 8.3 9.2 10.1 11.3	3.7 4.5 5.4 6.2 6.9 7.7 8.4 9.4	3.0 3.6 4.4 5.0 5.5 6.1 6.7 7.5	2.2 2.7 3.3 3.7 4.2 4.6 5.0 5.6	0.51 0.61 0.75 0.85 0.95 1.1 1.2 1.3	0.34 0.41 0.50 0.57 0.63 0.70 0.77 0.86	0.26 0.31 0.37 0.43 0.48 0.53 0.58 0.65	020 024 030 034 038 0.42 0.46 0.52
TT11003 (50)	15 20 30 40 50 60 75 90	VC VC C M M M	0.18 0.26 0.30 0.34 0.37 0.41 0.45	23 27 33 38 44 47 52 58	13.4 15.6 19.3 22 25 27 30 33	10.7 12.5 15.4 17.8 20 22 24 27	8.9 10.4 12.9 14.9 16.8 18.3 20 22	6.7 7.8 9.7 11.1 12.6 13.7 15.2 16.7	5.3 6.2 7.7 8.9 10.1 11.0 12.2 13.4	4.5 5.2 6.4 7.4 8.4 9.2 10.1 11.1	3.6 4.2 5.1 5.9 6.7 7.3 8.1 8.9	2.7 3.1 3.9 4.5 5.0 5.5 6.1 6.7	0.61 0.71 0.88 1.0 1.2 1.3 1.4	0.41 0.48 0.59 0.68 0.77 0.84 0.93 1.0	0.31 0.36 0.44 0.51 0.58 0.63 0.70 0.77	0.24 0.29 0.35 0.41 0.46 0.50 0.56 0.61
TT1 1004 (50)	15 20 30 40 50 60	XC VC C C	0.24 0.28 0.35 0.40 0.45 0.49	31 36 45 51 58 63	17.8 21 26 30 33 36	14.3 16.6 21 24 27 29	11.9 13.9 17.3 19.8 22 24	8.9 10.4 13.0 14.9 16.7 18.2	7.1 8.3 10.4 11.9 13.4 14.6	5.9 6.9 8.7 9.9 11.1 12.1	4.8 5.5 6.9 7.9 8.9 9.7	3.6 4.2 5.2 5.9 6.7 7.3	0.82 0.95 1.2 1.4 1.5 1.7	0.54 0.63 0.79 0.91 1.0 1.1	0.41 0.48 0.60 0.68 0.77 0.83	0.33 0.38 0.48 0.54 0.61 0.67
			/													

Hypro – GuardianAir Induction

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

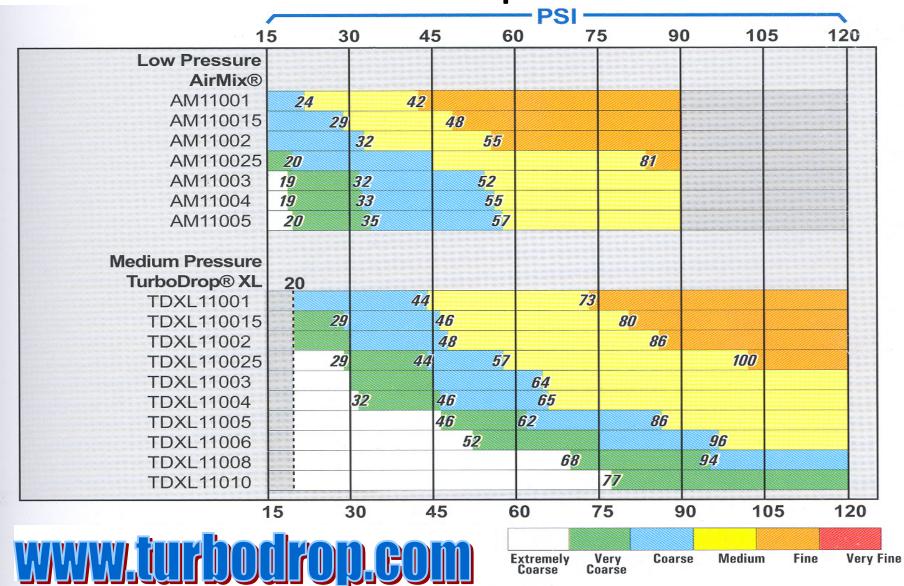
See Page 16, Hypro Spray Tip Guide



GuardianAir

	15 PSI	20 PSI	30 PSI	40 PSI	50 PSI	60 PSI	70 PSI	80 PSI	90 PSI	100 PSI
GA110-015	XC	XC	VC	С	C	С	M	M	M	M
GA110-02	XC	XC	VC	С	C	С	M	M	M	M
GA110-025	XC	XC	VC	С	C	C	С	С	M	M
GA110-03	XC	XC	VC	C	C	C	C	C	M	M
GA110-035	XC	XC	VC	C	C	C	C	C	M	M
GA110-04	XC	XC	VC	С	С	С	С	С	M	M
GA110-05	XC	XC	VC	С	C	C	С	С	M	M

Greenleaf Droplet chart:





The CP© Products Company
Flow Rate Calculator for
CP© Low Volume Sprayer Turbo
Nozzles with Droplet Classifications

Enter your nozzle spacing and MPH in the row which matches the orifice and pressure you want to use. Then, click **Calculate** and read the GPA results in the same row.

Calculate

	Enter your nozz which matches th to use. Read the		essure you want	Enter your nozzle spacing in inches.	Enter your speed in Miles Per Hour	Column #6 Gallons Per Acre
	Orifice	PSI	GPM	Spacing	MPH	GPA
		60	0.18			
	#1.5	50	0.17			
	#1.5 with #2 Tip	40	0.15			
	#2 HP	35	0.14			
_	<u> </u>	30	0.13			

CP® Floater/Sprayer Nozzle Droplet Key

Nozzle Classification* Category Threshold Values+	Dv0.1	Dv0.5	Dv0.9
Very Fine (VF)	≤45.9 µm	≤108.1μm	≤182.37µm
Fine (F)	≤70.7μm	≤166.96µm	≤342.29µm
Medium (M)	≤91.09µm	≤245.74µm	≤478.48µm
Coarse (C)	≤108.82µm	≤377.8µm	≤708.12µm
Very Coarse (VC)	≤129.22µm	≤434.9μm	≤1000.2µm
Extremely Coarse (XC)	≥129.22µm	≥434.9μm	≥1000.2µm

CP® 65-T-S Standard Sprayer Turbo Nozzle

	A 100 C							100000000000000000000000000000000000000					
Orifice ⇒ Def. Tip # PSI ↓	3 #3 #7.5	4 #3 #7.5	5 #3	5 #7.5 #10	ნ #3	6 #7.5	6 #10	8 #3	8 #7.5	8 #10	10 #3	10 #7.5	10 #10
30	#10 XC	#10 XC	XC	XC	VC	XC	XC	VC	ХC	XC	VC	XC	XC
1595500	XC	XC	VC	XC	VC	XC	XC	С	VC	XC	С	VC	XC
40	10000000		10000		1000				- 100				
50	XC	XC	VC	XC	VC	VC	XC	С	VC	XC	C	VC	XC
60	XC	XC	VC	XC	VC	VC	XC	C	VC	XC	С	VC	XC



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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.

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

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DOWN LOADS - Product literature, nozzle performance charts, price lists, it's all here and easy to print.

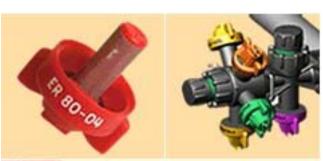














Calibration!!!!

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....

Page 9, 12, 14, 15

- 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



Tip No.	Liquid	Dropsize	Capacity				Acre -				
(Strainer	Pressure	Category	1 Nozzle	4	5	6	8	10	12	15	20
Screen Size)	in psi		in GPM	mph	mph	mph	mph	mph	mph	mph	mph
	15	XC	0.092	6.8	5.5	4.6	3.4	2.7	2.3	1.8	1.4
	20	XC	0.11	8.2	6.5	5.4	4.1	3.3	2.7	2.2	1.6
AIXR110015	30	С	0.13	9.7	7.7	6.4	4.8	3.9	3.2	2.6	1.9
(100 Mesh)	40	С	0.15	11.1	8.9	7.4	5.6	4.5	3.7	3.0	2.2
Green	50	С	0.17	12.6	10.1	8.4	6.3	5.0	4.2	3.4	2.5
	60	М	0.18	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7
	75	М	0.21	15.6	12.5	10.4	7.8	6.2	5.2	4.2	3.1
	90	М	0.23	17.1	13.7	11.4	8.5	6.8	5.7	4.6	3.4
	15	XC	0.12	8.9	7.1	5.9	4.5	3.6	3.0	2.4	1.8
	20	XC	0.14	10.4	8.3	6.9	5.2	4.2	3.5	2.8	2.1
AIXR11002	30	VC	0.17	12.6	10.1	8.4	6.3	5.0	4.2	3.4	2.5
(50 Mesh)	40	С	0.20	14.9	11.9	9.9	7.4	5.9	5.0	4.0	3.0
Yellow	50	С	0.22	16.3	863	Charles	No.	The state of the s		Cart.	9,20
	60	С	0.24	17.8	6.0						
	75	М	0.27	20	1995		11/20	1117	111:		1
	90	M	0.30	22	1000	1/1/1	21,	, ,			
	15	XC	0.15	11.1			4)	60	1	
	20	XC	0.18	13.4	1 38				0		
AIXR110025	30	XC	0.22	16.3		-		ps	1	200	ik. \ \
(50 Mesh)	40	VC	0.25	18.6			20	0	000	80-	# N
Violet	50	С	0.28	21		W= .		1	4		\mathcal{A}
	60	С	0.31	23	F.33	111=	1				
	75	С	0.34	25		1111	1	0	(4) 1	00	1//
	90	С	0.38	28			0	UE	H	טט	MAG
	15	XC	0.18	13.4				U.S.G/	UGE	1	
	20	XC	0.21	15.6	Marie N			MADE IN	U.S.A.		
AIXR11003	30	XC	0.26	19.3	1				ALC: N. P. Company	ER NE	DARTH
(50 Mesh)	40	VC	0.30	22		Dest	0	1 7 3			10 m
Blue	50	С	0.34	25		100000					ADDRESS.
	60	С	0.37	27	22	10.0	45.0	11.0	3.2	7.0	0.0
	75	С	0.41	30	24	20	15.2	12.2	10.1	8.1	6.1
	90 15	C XC	0.45	33	27 14.3	11.9	16.7	13.4	11.1	8.9	6.7
				17.8			8.9	7.1	5.9	4.8	3.6
	20	XC	0.28	21	16.6	13.9	10.4	8.3	6.9	5.5	4.2
AIXR11004	30	XC	0.35	26	21	17.3	13.0	10.4	8.7	6.9	5.2
(50 Mesh)	40	XC	0.40	30	24	19.8	14.9	11.9	9.9	7.9	5.9
Red	50	VC	0.45	33	27	22	16.7	13.4	11.1	8.9	6.7
	60	VC	0.49	36	29	24	18.2	14.6	12.1	9.7	7.3
	75	С	0.55	41	33	27	20	16.3	13.6	10.9	8.2

Droplet Size Calibration: A New Approach to Effective Spraying

Robert E. Wolf, American Professor and Exercises Specialist, Biological and Agricultural Engineering Department, Kansai State University, Manhattan, Kan. Scott Brettheser, Autoest Profesor and Exemples Specialis, Agricultured and Biological Engineering

Department, University of Historic, Orleans-Champaign, Elisab

Proper calibration of a sprayer to achieve accurate, safe, and efficient application of crop proteotion products has long been a goal for a prudent apray operator. The calibration steps are taken to ensure that the desired amount of spray material is being dispersed according to label recommendations. The steps taken to properly calibrate the sprayer will involve a calculation to determine the norde flow rate required to deliver the recommended carrier application volume in gallons per acre (GPA). The formula used.

$$GPM = \frac{GPA*MPH*W}{50400}$$

will incorporate the derived application volume (GPA), an appropriate ground speed in miles per hour (MPH), and notale spacing (W-inches) on the boom resulting in gallons per minute (GPM) flow rate per nozale. The proper orifice size for the norde type and pressure is then selected from the appropriate chart and the norder are placed on the sprayer at each norde location. Then the spray process must take place maintaining the calibrated speed and pressure to obtain the desired application

Most applicators are familiar with how to use flow rate charts from spray equipment catalogs and Web sites to determine the nousle orifice size needed as described above. Applicators are also comfortable in making those applications with the benefit of an automatic rate controller to help improve the uniformity of application volume across the field. However, a sprayer calibrated in this manner does not guarantee the application will achieve its highest level of efficacy or minimize drift.

The next step in calibration is designed to achieve this, but is one that most applicators are not yet familiar with. This calibration step requires applicators to seview droplet size charts to ch noted types, sizes, and pressure levels that will mee a specified droplet classification listed on the label. The droplet size created by a nozzle becomes very important when the efficacy of a particular plant protection product is dependent on coverage (Table I), or when the minimization of material leaving the target area is a priority. Droplet specifications given on the label are provided to guide applicators

Table 1. Droplet spectra category and recommendation for various pesticide types or uses. An X represents a recommendation.

ASABE Standard S-572D to plet spectrem Categories (1	Contact Insecticide and fungicide	Systemic Issecticide and fungicide	Contact foliar kerbicide	Systemic foliar herbicide	Sof- applied herbicide	in corporated soft-applied herbicide
Very Fine (VF)						
Fine (f)	×					
Medium (M)	×	×	×	×		
Coatse (C)		×		×	×	×
Very Coarse (VC)				×	×	×
Extremely Course (XC)						×

Based on V_{ess} (Volume Median Diameter – VMD) designation.

Kanasa State University Agricultural Experiment Station and Cooperative Extension Service

Fact Sheet: MF2869

Table 2. Spray quality categories.

Category (symbol)	Color Code				
Very Fine (VF)	Red				
Fine (F)	orange				
Medium (M)	yellow				
Coarse (C)	Blue				
Very Coarse (VC)	Green				
Extra Course (EC)	White				

in selecting how to best apply that material. Thus, consulting the nozzle manufacturers' droplet sizing charts is essential. Applicators should also remember the effect of changing speed when using an automatic rate controller. Major speed fluctuations will cause pressure adjustments that, while maintaining the GPA, may shift the droplet spectrum resulting in possible off-label applications.

To help applicators select nozzles according to droplet size, spray equipment manufacturers are including drop size charts with their respective catalogs and Web sites. These charts classify the droplet size from a given nozzle at various pressure levels according to a standard set up by the American Society of Agricultural and Biological Engineers (ASABE). The standard (S-572) rates droplets as very fine, fine, medium, coarse very coarse, and extra coarse. Droplet size categories are color-coded as shown in Table 2.

As an example, to achieve 10 GPA at 12 MPH with a 20-inch nozzle spacing, a "04" orifice would be suitable (ie. 8004, 11004) to deliver the 0.40 GPM flow rate (10 GPA * 12 MPH * 20 inch nozzle spacing divided by 5940). Regardless of the nozzle type selected, the pressure for this orifice scenario would need to be 40 PSI to deliver the correct GPA, resulting in a medium droplet with the XR nozzle (either 8004 or 11004), a coarse droplet with the TT nozzle, and an extra coarse with the AI nozzle (see charts below). Similar information can be found on nozzle manufacturers Web sites. Table 3 provides selected examples of companies and Web sites with this information.

Obviously the nozzle type selected for this application scenario will influence coverage as well as drift. For some fungicide and/or insecticide applica-

Spraying Systems - TeaJet	http://www.teejet.com/					
Greenleaf Technologies	http://www.turbodrop.com/					
Hypre Pumps	http://www.hypropumps.com/					
Wiger	http://www.wilgar.net/					
Hardl - North America	http://www.hardl-us.com/					
Delavan Ag Spray	http://www.delavanagspray. com/					
Lechler	http://www.lechierusa.com/					
Albuz	http://www.aibursaint-gobain com/index.htm					
CP Products	http://www.cpproductsinc.com/					
ABJ Agri Products	http://www.abjagri.com/					

tion scenarios the medium/fine option would be very close to the desired specifications for adequate coverage and efficacy. However, when applying certain herbicides, a larger droplet spectrum may be essential to minimize the drift potential.

An influencing factor then becomes the necessity for applicators to have a good knowledge of the 'mode of action' for the crop protection product being used. It is commonly thought that a systemic material such as glyphosate can work well with a medium, coarse, or maybe even a very coarse droplet spectrum while a contact material such as paraquat will need a droplet spectrum promoting more leaf coverage, ie. medium droplets.

A close review of the flow rate and droplet category charts would reveal that several nozzle options could be acceptable for the application scenatio mentioned above, each creating the required flow rate but different droplet sizes. In the above example, selecting a larger orifice, the 05 at approxi-mately 26 PSI, would deliver the correct flow rate (0.40 GPM), but would alter the droplet spectrum significantly; the XR would remain medium for the 11005, but would change to coarse with the 8005. With the 05 orifice, the TT becomes very coarse and the AI is now extra coarse. In fact the AI would not be recommended since it falls below its suggested operating pressure for improving coverage potential. Shifting to a smaller orifice, the 03 operated at approximately 70 PSI, results in the required flow rate (0.40 GPM), but the XR being fine for both fan angles and would not be recommended because the 70 PSI exceeds its maximum operating pressure of 60 PSI. The TT11003 would have a medium

droplet spectrum, but at 70 PSI is approaching its higher use limit. The AI11003 would become very coarse and can be recommended at 70 PSI. In the above scenarios, the low pressure concerns are related to lack of coverage and the high pressure concerns are related to increasing drift potential.

Droplet size charts for other pozzle types may differ from the examples above. Learning to use these droplet sixing charts is absolutely essential for proper pest control product application. It is also

highly possible that certain nozzle types may not meet the label specified droplet spectrum. turers' provide this information for the nozzle types they



Flaure 1. Nozzle types referenced in Table 4.

Table 4. Droplet spectra classification, nozzle type, psi, flow rates.

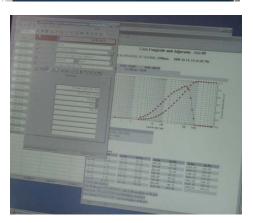
Nozzie Type	PSI	DSC1 80"	DSC1 110"	GPM2	Nozzie Type	PSI	DSC1	GPM2	Nozzie Type	PSI	DSC1	GPM2
XR 03	15	M	м	0.18		15	VC	0.18	A103	30	XC	0.26
	20	M	M	0.21	По4	20	VC	0.21		40	WE	0.30
	30	M	F	0.26		30	C	0.26		50	WC	0.34
	40	M	F	0.30		40	C	0.30		60	WE	0.37
	50	M	F	0.34		50	M	034		70	WC	0.40
	60	F	F	0.37		60	M	0.37		80	WC	0.42
	15	0	M	0.24		75	M	0.41		90	€	0.45
	20		M	0.28		90	M	0.45		100	€	0.47
XR 94	30	M	M	0.35		15	xc	0.24	8104	30	XC	0.35
AB 0+	40	M	M	0.40		20	VC	0.28		40	XC	0.40
	50	M	F	0.45		30	C	0.35		50	WE	0.45
	60	M	F	0.49		40	C	0.40		60	WE	0.49
	15	C	M	0.31		50	C	0.45	MI OF	70	WE	0.53
	20		M	0.35		60	C	0.49	AIOS	80	WC	0.57
XR 05	30	C	M	0.43		75	M	0.55		90	0	0.60
	40	M	M	0.50		90	M	0.60		100	€	0.63
	50	M	M	0.56		15	XC	031		30	XC	0.43
	60	M	F	0.61		20	VC	0.35		40	XC	0.50
	15			0.37		30	VC	0.43		50	WE	0.56
	20	C		0.42		40	C	0.50		60	WE	0.61
XR 06	30		M	0.52		50	C	0.56		70	WC	0.66
AR 00	40	C	M	0.60		60	C	0.61		80	WE	0.71
	50		M	0.67		75	C	83.0		90	WC	0.75
	60	C	M	0.73		90	M	0.75		100	0	0.79
						15	XC	0.37		30	XC	0.52
						20	XC	0.42		40	XC	0.60
				TT 06	30	VC	0.52	A106	50	WE	0.67	
					40	C	0.60		60	WC	0.73	
		1106	50	C	0.67	2100	70	WE	0.79			
				60	C	0.73		80	WC	0.85		
			75	C	0.82		90	WE	0.90			
							90	М	0.90	100	6	0.95
Color Code Designation Very Fine Fine				Medium Coarse Very Coarse Extra Co				extra Coa	150			

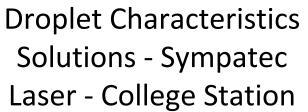
¹Droplet spectra classification based on ASABE S-572. ²Nozzle flow rate in gallons per minute at specified pressure

www.bae.ksu.edu/faculty/wolf/















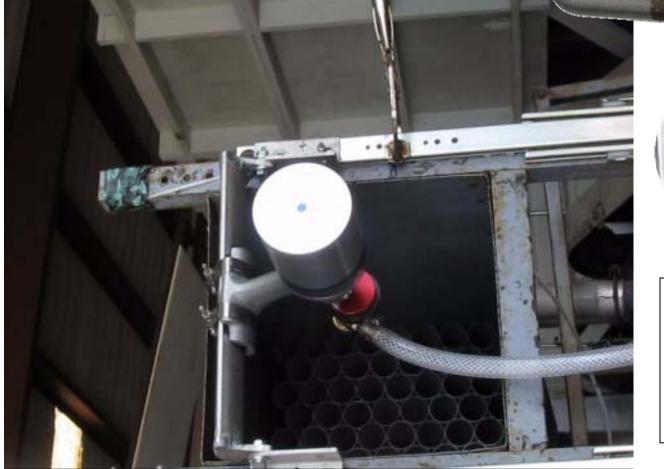
CP11TT4015 Flat-Fan

140 MPH40 PSI23 degree orientation



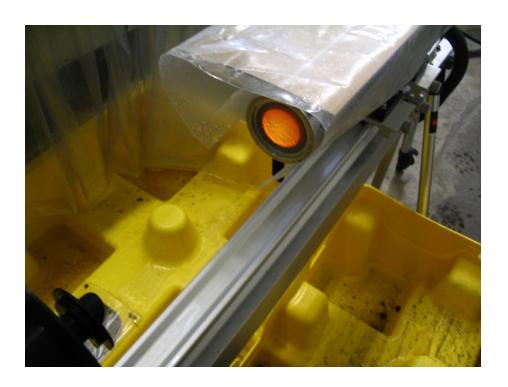


ASC D-12 Rotary Atomizer





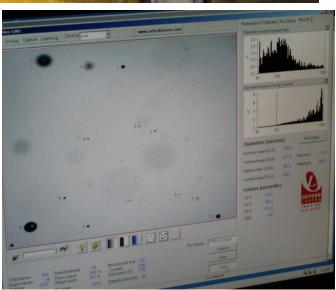
140 MPH 26 PSI 2 GPA Blade pitch #2







Droplet
Characteristics
Water
Oxford Laser
Wooster

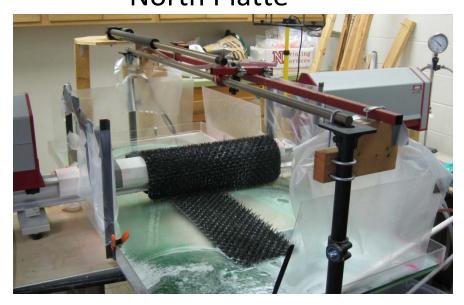


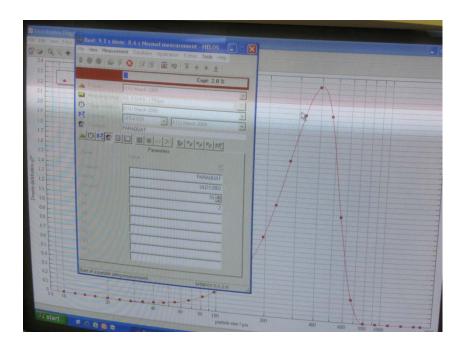






Droplet Characteristics-Solutions
Sympatec Laser
North Platte









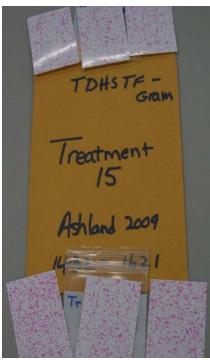


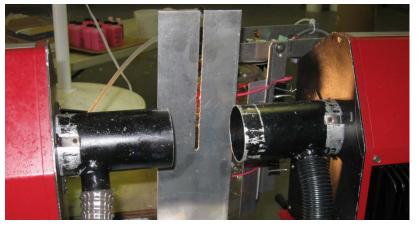
Droplet Characteristics
Water Sensitive & Kromekote
Paper – KSU







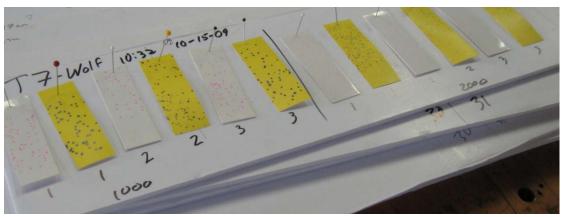


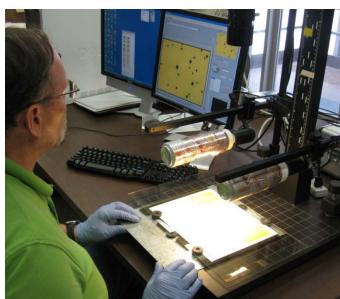












Droplet Characteristics – Spread Factors – Solutions College Station



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