Proceedings of the
2007 CPM Short Course and
MCPR Trade Show

December 4 – 6, 2007
Minneapolis Convention Center

Do not Reproduce or Redistribute Without Written Consent of the Author(s)
Spray Drift Management

Robert N. Klein
Extension Cropping Systems Specialist
WCREC, North Platte, NE
Why Interest in Drift?

- Spotty pest control
- Wasted chemicals
- Off-target damage
- More high value specialty crops
- Urban sprawl and.....
- Less tolerant neighbors
- Litigious Society

- More wind?? (Timing)
- Environmental impact
  – Water and Air Quality
- Public more aware of pesticide concerns!
  (Negative) (Perceptions)
- Result-higher costs-$$$


Technical Aspects of Spray Drift
Definition of Drift:

Movement of spray particles and vapors off-target causing less effective control and possible injury to susceptible vegetation, wildlife, and people.

Adapted from National Coalition on Drift Minimization 1997 as adopted from the AAPCO Pesticide Drift Enforcement Policy - March 1991
Types of Drift:

Vapor Drift - associated with volatilization (gas, fumes)

Particle Drift - movement of spray particles during or after the spray application
Relative Damage to Tomatoes by Vapors from 2,4-D

2,4-D held at three temperatures, ratings taken 24 hours after exposure, with 1 – no effect and 6 – severe damage

<table>
<thead>
<tr>
<th>2,4-D Formulation</th>
<th>Temperature and hours of exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>70 -75° F</td>
</tr>
<tr>
<td></td>
<td>2 hr</td>
</tr>
<tr>
<td>Butyl ester (High volatile)</td>
<td>3.5</td>
</tr>
<tr>
<td>Butoxyethanol ester (Low volatile)</td>
<td>1.0</td>
</tr>
<tr>
<td>Dimethylamine (Non-volatile)</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Source: Baskin and Walker
Particle Drift – *Big 4*

1. Wind Speed
Wind Speed

When the wind speed doubles, there is almost a 700% increase in drift when readings are taken from 90 feet downwind from the sprayer. Hence the recommendation of spraying in 10 mph winds or less.
Particle Drift – *Big 4*

1. Wind Speed
2. Boom Height
Boom Height

When the boom height was increased from 18 to 36 inches, the amount of drift increased 350% at 90 feet downwind.
Particle Drift – *Big 4*

1. Wind Speed
2. Boom Height
3. Spray Particle Size
The Effect of Droplet Size on Drift Potential

<table>
<thead>
<tr>
<th>Diameter, microns</th>
<th>Time to fall 10 feet in still air</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Fog)</td>
<td>28 hours</td>
</tr>
<tr>
<td>10 (Fog)</td>
<td>17 minutes</td>
</tr>
<tr>
<td>100 (Mist)</td>
<td>11 seconds</td>
</tr>
<tr>
<td>200 (Fine Spray)</td>
<td>4 seconds</td>
</tr>
<tr>
<td>400 (Coarse Spray)</td>
<td>2 seconds</td>
</tr>
<tr>
<td>1,000 (Coarse Spray)</td>
<td>1 second</td>
</tr>
</tbody>
</table>
Particle Drift – *Big 4*

1. Wind Speed
2. Boom Height
3. Spray Particle Size
4. Distance from Susceptible Vegetation
Distance Downwind

If the distance downwind is doubled, the amount of drift decreases five-fold. If the distance downwind increases from 100 to 200 feet, you have only 20% as much drift at 200 feet as at 100 feet.
Wind Direction:

- Wind **direction** is very important
  - Know the location of sensitive areas - consider safe buffer zones.
  - Do not spray at any wind speed if it is blowing towards sensitive areas - all nozzles can drift.
  - Spray when breeze is gentle, steady, and blowing **away** from sensitive areas.
  - “Dead calm” conditions are **never** recommended.
However, Drift Potential May be High at Low Wind Speeds

• Because:
  – Light winds (0-3 mph) tend to be unpredictable and variable in direction.
  – Calm and low wind conditions may indicate presence of a temperature inversion.

• Drift potential is lowest at wind speeds between 3 and 10 mph (gentle but steady breeze) blowing in a safe direction.
# Wind Meters

<table>
<thead>
<tr>
<th>Name</th>
<th>Features</th>
<th>Cost*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind Wizard</td>
<td>Mechanical</td>
<td>41.70</td>
</tr>
<tr>
<td>Kestrel 1000</td>
<td>Maximum, average, current wind speed - knots, feet/min, meters/sec, mph</td>
<td>90.00</td>
</tr>
<tr>
<td>Kestrel 2000</td>
<td>Maximum, average, current wind speed, temp, wind chill - knots, feet/min, meters/sec, mph</td>
<td>120.00</td>
</tr>
<tr>
<td>Kestrel 3000</td>
<td>All wind speed features plus temp, wind chill, dew point, heat index, relative humidity</td>
<td>131.20</td>
</tr>
<tr>
<td>Kestrel 4000</td>
<td>All wind speed features plus, temp, wind chill, altitude, wet bulb, dew point, barometric pressure, relative humidity, and heat index</td>
<td>251.10</td>
</tr>
</tbody>
</table>

*Prices for Wind Meters taken from Gempler’s 2006 Master Catalog
Wind Current Effects

• Wind currents can drastically affect spray droplet deposition
• Structures drastically affect wind currents
  – Wind breaks
  – Tree lines and orchards
  – Houses and barns
  – Hills and valleys
Wind Patterns Near Shelterbelts

Distance from shelterbelt (tree heights)

Generalized pattern of wind in the neighborhood of a shelterbelt.
Wind Patterns Near Treelines

Adapted from Survey of Climatology: Griffiths and Driscoll, Texas A&M University, 1982
Wind Patterns Around Buildings

Diagram of wind around a building.
Adapted from Farm Structures*

* H.J. Barre and L.L. Sammet, Farm Structures (Wiley, 1959)
Wind Patterns Around Buildings

Diagram of Wind Around a Building
Adapted From Farm Structures*

* H.J. Barre and L.L. Sammet, Farm Structures (Wiley, 1959)
Under normal conditions air tends to rise and mix with the air above. Droplets will disperse and will usually not cause problems.
Under these conditions the temperature increases as you move upward. This prevents air from mixing with the air above it. This causes small suspended droplets to form a concentrated cloud which can move in unpredictable directions.
Recognizing Inversions:

- Under clear to partly cloudy skies and light winds, a surface inversion can form as the sun sets.
- Under these conditions, a surface inversion will continue into the morning until the sun begins to heat the ground.
adjoining soybean field, sprayed by air, late evening
adjoining soybean field, sprayed by air, late evening
Precautions for Inversions:

- Surface inversions are common.
- Be especially careful near sunset and an hour or so after sunrise, unless...
  - There is low heavy cloud cover
  - The wind speed is greater than 5-6 mph at ground level
  - 5 degree temp rise after sun-up
- Use of a smoke bomb or smoke generator is recommended to identify inversion conditions.
Drift Management

- Look around for potential problems
- Be aware of environmental conditions
  - Inversions
- Reduce pressure
- Lower boom height
Cutting Droplet Size in Half Results in Eight Times the Number of Droplets.
Evaluating a New Nozzle Tip

1) Efficacy

2) Drift
Origin of Standardized Spray Droplet Size Categories

• 1985 – British Crop Protection Council (BCPC)
  – Droplet size classifications, primarily designed to enhance efficacy
  – Uses the term SPRAY QUALITY for droplet size categories

• 2000 – ASAE Standard S572
  – Droplet size classifications, primarily designed to control spray drift and secondarily efficacy
  – Uses the term DROPLET SPECTRA CLASSIFICATION for droplet size categories
ASAE S572
Specifics of Standards

• Based on spraying water through reference nozzles
• Nozzle manufacturers can conduct the tests
• Must use a set of reference tips and a laser-based instrument
• Droplet Spectra measurements must be with the same:
  – Instrument, measuring method, sampling technique, scanning technique, operator, and in a similar environmental condition
Half of spray volume is of smaller droplets

Half of spray volume is of larger droplets

VMD
ASAE S572 Standard Classification category threshold values for flat spray nozzles.

<table>
<thead>
<tr>
<th>Classification category threshold</th>
<th>Nozzle spray angle</th>
<th>Nominal rated flow rate¹</th>
<th>Reference flow rate</th>
<th>Reference operating pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(°)</td>
<td>(gpm)</td>
<td>(Lpm)</td>
</tr>
<tr>
<td>VF/F</td>
<td>11001</td>
<td>0.10</td>
<td>0.13</td>
<td>0.49</td>
</tr>
<tr>
<td>F/M</td>
<td>11003</td>
<td>0.30</td>
<td>0.31</td>
<td>1.17</td>
</tr>
<tr>
<td>M/C</td>
<td>11006</td>
<td>0.60</td>
<td>0.51</td>
<td>1.93</td>
</tr>
<tr>
<td>C/VC</td>
<td>8008</td>
<td>0.80</td>
<td>0.76</td>
<td>2.88</td>
</tr>
<tr>
<td>VC/XC</td>
<td>6510</td>
<td>1.00</td>
<td>0.85</td>
<td>3.22</td>
</tr>
</tbody>
</table>

¹Nominal rated flow rate is 40psi (2.8 bars) and is for nozzle size selection only.
ASAE S572 Standard

Example Reference Graph

- XC: Very Coarse/Extremely Coarse
- VC: Coarse/Very Coarse
- C: Medium/Coarse
- M: Fine/Medium
- F: Fine
- VF: Very Fine/Fine

Y-axis: Drop Size (microns)
X-axis: Cumulative Volume Fraction
Turbo TeeJet (TT)
### Turbo TeeJet® (TT)

<table>
<thead>
<tr>
<th>Model</th>
<th>PSI 15</th>
<th>PSI 20</th>
<th>PSI 25</th>
<th>PSI 30</th>
<th>PSI 35</th>
<th>PSI 40</th>
<th>PSI 50</th>
<th>PSI 60</th>
<th>PSI 70</th>
<th>PSI 80</th>
<th>PSI 90</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT11001</td>
<td>C</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>TT11002</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>TT11003</td>
<td>VC</td>
<td>VC</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>TT11004</td>
<td>XC</td>
<td>VC</td>
<td>VC</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>TT11005</td>
<td>XC</td>
<td>VC</td>
<td>VC</td>
<td>VC</td>
<td>VC</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td>TT11006</td>
<td>XC</td>
<td>XC</td>
<td>VC</td>
<td>VC</td>
<td>VC</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>M</td>
</tr>
<tr>
<td>TT11008</td>
<td>XC</td>
<td>XC</td>
<td>VC</td>
<td>VC</td>
<td>VC</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>
## Treatment Parameters Used to Evaluate Three Nozzle Types

<table>
<thead>
<tr>
<th>Trt</th>
<th>Nozzle</th>
<th>Spray Particle Size</th>
<th>Volume (gpa)</th>
<th>Speed (mph)</th>
<th>Speed (km/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>XR11005</td>
<td>Coarse</td>
<td>10</td>
<td>8.6</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>DG11005</td>
<td>Coarse</td>
<td>10</td>
<td>8.6</td>
<td>14</td>
</tr>
<tr>
<td>3</td>
<td>TF-VS2.5</td>
<td>Extremely Coarse</td>
<td>10</td>
<td>8.6</td>
<td>14</td>
</tr>
<tr>
<td>4</td>
<td>XR11004</td>
<td>Medium</td>
<td>7.5</td>
<td>9.2</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>DG11004</td>
<td>Coarse</td>
<td>7.5</td>
<td>9.2</td>
<td>15</td>
</tr>
<tr>
<td>6</td>
<td>TF-VS2</td>
<td>Extremely Coarse</td>
<td>7.5</td>
<td>9.2</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>XR1003</td>
<td>Fine</td>
<td>5.0</td>
<td>10.3</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>DG11003</td>
<td>Coarse</td>
<td>5.0</td>
<td>10.3</td>
<td>17</td>
</tr>
<tr>
<td>9</td>
<td>Untreated Check</td>
<td></td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

*All treatments applied at 30 psi (2 bars)*

*Herbicide applied was Paraquat + Atrazine (0.31 + 0.5 lb/A) (0.35 + 0.56 kg ai/ha)*
TR Kochia Control 9 DAT
with XR, DG, and TF Nozzles at 30 psi (2 bars)
Paraquat + Atrazine at 0.31 & 0.5 lb/A (0.35 + 0.56 kg/ha)

<table>
<thead>
<tr>
<th>XR TeeJet</th>
<th>DG TeeJet</th>
<th>Turbo FloodJet</th>
</tr>
</thead>
<tbody>
<tr>
<td>.5 M</td>
<td>.5 C</td>
<td>.25 EC</td>
</tr>
<tr>
<td>.4 M</td>
<td>.4 C</td>
<td>.2 EC</td>
</tr>
<tr>
<td>.3 F</td>
<td>.3 C</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Carrier Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 gpa 94 L/ha</td>
</tr>
<tr>
<td>7.5 gpa 70 L/ha</td>
</tr>
<tr>
<td>5 gpa 47 L/ha</td>
</tr>
</tbody>
</table>
Green Foxtail Control 35 DAT with XR, DG, and TF Nozzles

Paraquat + Atrazine at 0.31 & 0.5 lb/A (0.35 + 0.56 kg/ha)

Carrier Volume

<table>
<thead>
<tr>
<th>Carrier Volume</th>
<th>XR TeeJet</th>
<th>DG TeeJet</th>
<th>Turbo FloodJet</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 gpa 94 L/ha</td>
<td>.5 .5 .25</td>
<td>.4 .4 .2</td>
<td>.3 .3</td>
</tr>
<tr>
<td>7.5 gpa 70 L/ha</td>
<td>.5 .5 .25</td>
<td>.4 .4 .2</td>
<td>.3 .3</td>
</tr>
<tr>
<td>5 gpa 47 L/ha</td>
<td>.5 .5 .25</td>
<td>.4 .4 .2</td>
<td>.3 .3</td>
</tr>
</tbody>
</table>
### Roundup Ready Corn: Medium & Coarse Droplets Showed Lower % Retention

Fine = XR 110015  
Medium = TT 110015  
Very Coarse = AI 110015  
All Nozzles at 34 psi (2.3 bars)

<table>
<thead>
<tr>
<th>Droplet Size</th>
<th>% Retention (Actual over Calculated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine</td>
<td>47 $\nless$ 2</td>
</tr>
<tr>
<td>Medium</td>
<td>37 $\nless$ 7</td>
</tr>
<tr>
<td>Coarse</td>
<td>38 $\nless$ 4</td>
</tr>
</tbody>
</table>

Paul Feng, Monsanto
Even at lower retention, large droplets showed higher uptake & translocation in RR corn

Feng et al., Weed Sci, in press.

Paul Feng, Monsanto
Comparative effectiveness of Chipco 26019® in the control of Sclerotinia dollar sport when applied with Floodjet® TK-30 nozzles vs. flat fan T-8002 tips. 8002 at 30 psi (2 bars) is medium size spray droplet but close to fine in spraying systems book.
Sympatec Helos/KF Analyzer

- System is comprised of:
  - 5 mw Helium-neon laser
  - Adjustable measuring zone
  - 31 ring multi element detector
  - Auto alignment system
  - High speed fiber optic data transfer cable
  - Computer with Windox 4 operating software for control and operation of the Helos central unit
XR Nozzles

Nozzle Pressure kPa – psi

XR 11002 207 - 30
XR 11004 207 - 30
XR 11006 207 - 30
XR 11008 207 - 30

Water

Nozzle Pressure kPa - psi

TT 11002 207 - 30
TT 11004 207 - 30
TT 11006 207 - 30
TT 11008 207 - 30

XR Nozzles

Pressure- 30 psi (2 bars)

Water
AIXR 11004
Treatments with Water

AI 11004
60 psi

AIXR 11004
45 psi
Treatments with Water

AI 11004
60 psi

AIXR 11004
45 psi
Volume Median Diameter (VMD)

- **Water**
- **RWM + 2% AMS**
- **RWM + 1% AMS + Array**
- **RWM + 2% AMS + Border**
- **RWM + 2% AMS + Placement**
- **% less than 210 Microns**

### Microns

<table>
<thead>
<tr>
<th>Product</th>
<th>PSI</th>
<th>Bars</th>
<th>% less than 210 Microns</th>
</tr>
</thead>
<tbody>
<tr>
<td>11004XR</td>
<td>40</td>
<td>2.8</td>
<td>37, 51, 36, 35, 45</td>
</tr>
<tr>
<td>11004TT</td>
<td>40</td>
<td>2.8</td>
<td>23, 30, 14, 15, 26</td>
</tr>
<tr>
<td>TF 2</td>
<td>40</td>
<td>2.8</td>
<td>19, 22, 14, 13, 22</td>
</tr>
<tr>
<td>11003AI</td>
<td>70</td>
<td>4.8</td>
<td>10, 17, 29, 29, 15</td>
</tr>
</tbody>
</table>
### Volume Median Diameter (VMD)

<table>
<thead>
<tr>
<th></th>
<th>XR 11004</th>
<th>AIXR 11004</th>
<th>TT 11004</th>
<th>TF 2</th>
<th>AI 11003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>40 psi</td>
<td>40 psi</td>
<td>40 psi</td>
<td>40 psi</td>
<td>70 psi</td>
</tr>
<tr>
<td>...</td>
<td>2.8 bars</td>
<td>2.8 bars</td>
<td>2.8 bars</td>
<td>2.8 bars</td>
<td>4.8 bars</td>
</tr>
</tbody>
</table>

**Water**

**RWM + 2% AMS**

**RWM + 1% AMS + Array**

**RWM + 2% AMS + Border**

**RWM + 2% AMS + Placement**

% less than 210 microns

**Volume Median Diameter (VMD)**

- 0 %
- 10 %
- 20 %
- 30 %
- 40 %
- 50 %
- 60 %
- 70 %
- 80 %
- 90 %
- 100 %
- 110 %
- 120 %
- 130 %
- 140 %
- 150 %

**Microns**

- 0
- 50
- 100
- 150
- 200
- 250
- 300
- 350
- 400
- 450
- 500

**Percent**

- 0
- 10
- 20
- 30
- 40
- 50
- 60
- 70
- 80
- 90
- 100
- 110
- 120
- 130
- 140
- 150

**Pressure Values**

- 40 psi: 2.8 bars
- 70 psi: 4.8 bars

**Note:** The chart provides a visual representation of VMD values for different conditions and pressures, with specific values indicated for each category.
Volume Median Diameter (VMD)

- Water
- 22 oz Roundup WeatherMax in 10 gpa of Water + 2% AMS

% less than 210 microns

Microns

<table>
<thead>
<tr>
<th>Microns</th>
<th>AIXR 11004</th>
<th>AI 11003</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-50</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>51-100</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>101-150</td>
<td></td>
<td></td>
</tr>
<tr>
<td>151-200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>201-250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>251-300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>301-350</td>
<td></td>
<td></td>
</tr>
<tr>
<td>351-400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>401-450</td>
<td></td>
<td></td>
</tr>
<tr>
<td>451-500</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

40 psi
70 psi
<table>
<thead>
<tr>
<th>Nozzle</th>
<th>PSI</th>
<th>Spraying Systems</th>
<th>Classification</th>
<th>Water</th>
<th>Roundup Weather Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI 10025</td>
<td>50</td>
<td>Very Coarse</td>
<td>Very Coarse</td>
<td>Very Coarse</td>
<td>Coarse</td>
</tr>
<tr>
<td>TF 2</td>
<td>20</td>
<td>Extremely Coarse</td>
<td>Very Coarse to Extremely Coarse</td>
<td>Very Coarse to Extremely Coarse</td>
<td>Very Coarse</td>
</tr>
<tr>
<td>TT 11003</td>
<td>35</td>
<td>Coarse</td>
<td>Very Coarse</td>
<td>Very Coarse</td>
<td>Coarse</td>
</tr>
<tr>
<td>XR 11004</td>
<td>20</td>
<td>Medium</td>
<td>Coarse</td>
<td>Coarse</td>
<td>Medium</td>
</tr>
<tr>
<td>XR 11003</td>
<td>35</td>
<td>Fine</td>
<td>Fine</td>
<td>Fine</td>
<td>Fine</td>
</tr>
</tbody>
</table>
Percent Visual Control of Corn, Oil Sunflower, Velvetleaf, Green Foxtail and Waterhemp With Roundup WeatherMax
R. Klein, S. Knezevic, A. Martin, R. Wilson, B. Kappler and F. Roeth, 2004

<table>
<thead>
<tr>
<th>Variety</th>
<th>XR11003</th>
<th>XR11004</th>
<th>TT11003</th>
<th>TF2</th>
<th>AI110025</th>
</tr>
</thead>
<tbody>
<tr>
<td>F - F</td>
<td>53</td>
<td>31</td>
<td>22</td>
<td>13</td>
<td>20</td>
</tr>
<tr>
<td>C - M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC - C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EC - VC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VC - C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pressure
- XR11003: 35
- XR11004: 20
- TT11003: 35
- TF2: 20
- AI110025: 50

Water to Spray Solution
- % < 210 um

WeatherMax Rate:
- Knezevic = 22, 11 & 5.5 oz
- All others = 16.5, 8.25 & 4.125 oz
Volume Median Diameter & Percent of Volume 210 Microns and Less

Tilt at 8 oz (.57 L/ha)

- Water
- Tilt 2.5 gpa (23 L/ha)
- Tilt 5 gpa (47 L/ha)
- Tilt 10 gpa (94 L/ha)

Microns

<table>
<thead>
<tr>
<th>Microns</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
<th>350</th>
<th>400</th>
</tr>
</thead>
<tbody>
<tr>
<td>253</td>
<td>253</td>
<td>300</td>
<td>315</td>
<td>317</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36.1</td>
<td>36.1</td>
<td>21.3</td>
<td>18.2</td>
<td>16.9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Percent

<table>
<thead>
<tr>
<th>Percent</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>245</td>
<td>245</td>
<td>269</td>
<td>279</td>
<td>279</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39.5</td>
<td>39.5</td>
<td>31.7</td>
<td>27.9</td>
<td>26.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

XRC 11003
@ 30 psi
2 bars

XRC 11005
@ 60 psi
4 bars
Volume Median Diameter & Percent of Volume 210 Microns and Less

Quadris at 21 oz (1.5 L/ha)

Water  Quadris 2.5 gpa (23 L/ha)  Quadris 5 gpa (47 L/ha)  Quadris 10 gpa (94 L/ha)

Microns

0 50 100 150 200 250 300 350 400

Percent

0 10 20 30 40 50 60 70 80 90 100

Quadris at 21 oz (1.5 L/ha)

Water  Quadris 2.5 gpa (23 L/ha)  Quadris 5 gpa (47 L/ha)  Quadris 10 gpa (94 L/ha)

Microns

0 50 100 150 200 250 300 350 400

Percent

0 10 20 30 40 50 60 70 80 90 100

XRC 11003
@ 30 psi
2 bars

XRC 11005
@ 60 psi
4 bars
Volume Median Diameter & Percent of Volume 210 Microns and Less

Quilt at 21 oz (1.5 L/ha)

- Water
- Quilt 2.5 gpa (23 L/ha)
- Quilt 5 gpa (47 L/ha)
- Quilt 10 gpa (94 L/ha)

Microns

<table>
<thead>
<tr>
<th>Diameter (Microns)</th>
<th>Water</th>
<th>Quilt 2.5 gpa</th>
<th>Quilt 5 gpa</th>
<th>Quilt 10 gpa</th>
</tr>
</thead>
<tbody>
<tr>
<td>253</td>
<td>36.1</td>
<td>40.1</td>
<td>39.6</td>
<td>39.2</td>
</tr>
<tr>
<td>240</td>
<td></td>
<td></td>
<td>40.1</td>
<td>40.4</td>
</tr>
<tr>
<td>251</td>
<td>36.8</td>
<td></td>
<td>40.4</td>
<td>40.2</td>
</tr>
<tr>
<td>265</td>
<td>31.8</td>
<td></td>
<td>40.2</td>
<td>32.9</td>
</tr>
</tbody>
</table>

XRC 11003
@ 30 psi
2 bars

XRC 11005
@ 60 psi
4 bars
Volume Median Diameter & Percent of Volume
210 Microns and Less

Water | Tilt at 8 oz (.57 L/ha) | Quadris at 21 oz (1.5 L/ha) | Quilt at 21 oz (1.5 L/ha)

- XRC11003
- XRC11005

XRC11003 @ 30 psi (2 bars) | XRC11005 @ 60 psi (4 bars)

- 23 L/ha
- 47 L/ha
- 94 L/ha
Volume Median Diameter (VMD) & Percent Less Than 210 Microns

NIS rate is 0.25%; COC rate is 1 qt/A (2.3 L/ha); AMS rate is 17 lb/100 gal (2 kg/100 L)

Status @ 5 oz/a (.35 kg/ha)