Tank Mix and Adjuvants Summary

- The entire tank mix determines droplet size
- Adjuvants added to improve spray performance
- Droplet size spectra
- Drift potential
- Surfactants
- Drift control adjuvants
- Fertilizers

SDTF Generic Approach

- The entire tank mix, not the a.i. Determines droplet size and drift potential
- Droplet size spectra can be classified using generic categories (ASAE S-572 droplet size categories)

The Entire Tank Mix

- Adjuvants as part of the tank mix
- Adjuvants are used with real tank mixes (not water), so tests should not only be based on mixing with water
- Some effects vary with different application conditions (especially nozzle type)

Nozzle Catalogue Spray Quality for Water

DropKick® Spreadsheet
DropKick® in AgDRIFT®

How Important is the Tank Mix in Atomization?
- Application parameters (nozzle type, use, pressure, air speed, etc) have major effect on atomization
- Tank mix is generally less important than application parameters, but still significant for many applications

Nozzle Selection

Previous Studies
- SDTF found differences in spray quality from >200 different tank mixes with different formulation, a.i. and pesticide types
- SDTF also looked at some tank mix adjuvants, but only from perspective of surface tension and viscosity effects on atomization and drift
- Subsequent researchers have looked at other effects on spray formation and distribution patterns

Surfactants and Emulsions
- Typically added to increase retention/rainfastness, spreading, sticking, mixing
- Many different products but several major chemistry groups
- Main effect is on surface tension, which can be measured using standard techniques
Polymers
- Used as drift control adjuvants/deposition aids
- Hundreds of products but only a few chemistries
- Need to be sure of compatibility with nozzle type being used and tank mix partners - tests with water may not be representative
- Some polymers break down when pumped giving change in performance over time

Effects of Polymers on Droplet Size Spectrum
- Typically increase $D_{0.5}$
- Generally increase relative span
- Correlation between droplet size and extensional viscosity (elongational viscosity)

<table>
<thead>
<tr>
<th>Material</th>
<th>Spray Fluid Type</th>
<th>Volume Median Diameter (Microns)</th>
<th>Relative Span</th>
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</thead>
<tbody>
<tr>
<td>Water</td>
<td>Standard</td>
<td>198</td>
<td>1.4-1.5</td>
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<tr>
<td>Bentonite</td>
<td>Dispersion</td>
<td>194</td>
<td>1.55</td>
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<tr>
<td>Kaolin</td>
<td>Dispersion</td>
<td>201</td>
<td>1.50</td>
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<tr>
<td>Calcium carbonate</td>
<td>Dispersion</td>
<td>202</td>
<td>1.48</td>
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<tr>
<td>Hydrated silica</td>
<td>Dispersion</td>
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<td>1.48</td>
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<tr>
<td>EC blank formulation</td>
<td>Emulsion aromatic solvent</td>
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<td>1.15</td>
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<tr>
<td>Sun-bi 11</td>
<td>Emulsion oil blend</td>
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<tr>
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<td>Emulsion/soluble surfactant</td>
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<td>1.12</td>
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<tr>
<td>C10 EO6</td>
<td>Soluble surfactant</td>
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</tbody>
</table>

Spray Drift
- Any adjuvant that causes an increase in “fines” (~<150 µm) may increase drift potential in aerial and many ground rig applications
- Although droplet size is main influence on drift, other factors are also important (e.g. droplet velocities, trajectories, evaporation rates, encapsulation, etc)

Fertilizer Effects
- Some suggestions that fertilizers increase drift potential
- Probably actually increase drift damage rather than drift exposure risk
- Literature reports on increased activity of glyphosate with ammonium sulfate
- SDTF conducted atomization tests showing no effect on droplet size spectra
New SDTF Fact Sheet

- New fact sheet on tank mixes and nozzles
- Explains droplet size classification and SDTF atomization and physical property studies
- Available in hard copy and on www.agdrift.com

Conclusions

- Formulation effects on nozzle performance are important, influencing atomization, retention, efficacy and spray transport/drift
- Entire tank mix, not a.i. or formulation type, affects drift potential
- Entire droplet size spectrum (especially “fine” end) important, not only VMD
- Surfactants and crop oils have varying effects
- Emulsions may increase droplet size and narrow the spectrum width

Conclusions

- Some polymers broken down by pumping
- Some new nozzle designs may be more sensitive to formulation effects
- Other effects: encapsulation, evaporation retardants, etc
- Ongoing and future work looking at total spray process