PESTICIDE SAFETY FOR STUDENT WORKERS

This article is based on a presentation by Dr. Melanie Filotas, who delivered it as part of the 2019 agriculture...
Last 25 Years

- Low-Drift tips
Last 25 Years

- Low-Drift tips
- Environmental awareness, Buffer Zones
Last 25 Years

- Low-Drift tips
- Environmental awareness, Buffer Zones
- High Clearance
  - Faster
  - Higher booms
  - Heavier
Last 25 Years

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- 3” Plumbing
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- 3” Plumbing
- Pulse Width Modulation
Last 25 Years

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- Fungicides, Growth Regulators
- 3” Plumbing
- Pulse Width Modulation
- Social Media
Drift remains complex
Initial Release is Intuitive

- Droplet size
- Boom height
- Wind speed
- etc.

Subsequent Behavior is Not

- Atmospheric turbulence
- Surface roughness (crop)
- Terrain
- etc.
Field Sampler Layout

Wind Direction ± 25°

120 m

300 m

18 m

120 m
Drift Spray Accountancy

82% On Target
10% 5% 1% 0.3% Off Target
1 m 2 m 5 m 5-120 m
Drift research results depend primarily on the research group.
Three Research Groups, Same Methods

- Petri, BCS, Crop
- Petri, JKI, Crop
- Petri, Agrimetrix, Stubble

Deposit (% of Applied) vs. Distance (m)
Variability

Distance (m)

Deposit (% of Applied)

- Petri, JKI Min
- Petri, JKI, Max
Shrouds reduce, but do not eliminate drift
Shrouds and Shields

Wolf et al., 1993
Low drift nozzles are the new shrouds
DRT benefits depend on what you measure
XR8003 (conventional)

2.9% of applied dose

2.5% of applied dose

0.43% of applied dose

5.7 x
AI110025 (low-drift)

0.67% of applied dose

0.5% of applied dose

2.1 x

0.21% of applied dose
There is no safe (intermediate) distance
Caldwell & Wolf, 2006
Deposited drift measurements are very variable
Medium vs X. Coarse

Spray deposit (% of applied) vs Downwind distance (m)

XR11005 (High boom, Medium)
DR11005 (High boom, X. Coarse)
The cost of drift is paid at its destination
On-Swath Deposit (2011)
On-Swath Deposit (2000)

\[ R^2 = 0.074 \]

On-swath deposit (% of applied)

Wind speed (km/h)
Very Coarse sprays work
wild oats

green foxtail

barnyard grass

quack grass
Grassy Targets

Droplet Size

Medium  Coarse  Very Coarse  Extra Coarse

Pest Control

Droplet Size
Broadleaf Targets

Droplet Size

Pest Control

Medium | Coarse | Very Coarse | Extra Coarse

Droplet Size

Sprayers101
The drift from multiple spray passes is additive
Field Sampler Layout

- Dimensions:
  - 400 m (vertical)
  - 180 m (horizontal)
  - 120 m (horizontal)
Multiple Pass Trial

- **Deposit % of applied**
- **Downwind distance (m)**

- **Single Pass**
- **All Passes, 10 samplers added**
- **Single Pass, modelled 10 x**
Relative Buffer Zones with $RQ = 4000$

- Single Pass
- Multiple pass additive model
- Multiple pass trial
- Multiple pass trial (with dust)

Buffer Zone (% of Single Pass)
Buffer Zones and DRTs only work for non-volatile products.
It’s better to spray in wind than (inverted) calm
XR8003 (M), 24” boom, 8 mph

Wind speed (km/h) vs. Drift (% of applied)

- **Airborne** (△)
- **Ground 5-120** (●)

- $R^2 = 0.791$
- $R^2 = 0.514$
AI110025 (XC), 24” boom, 8 mph

Wind speed (km/h)
Drift (% of applied)

Airborne
Ground 5-120

R² = 0.716
R² = 0.055
TT11005 (VC), 30” boom, 14 mph
AI11004 (VC), 30” boom, 14 mph

Drift (% of applied) vs Wind speed (km/h)

- **Airborne**
- **Ground 5-120**

\[ R^2 = 0.244 \]
\[ R^2 = 0.228 \]
We can only respond to, not control, technological developments
20” Boom height, 8 mph

Airborne drift at 5 m (% of emitted) vs. Wind speed (mph)

- TeeJet XR8003
- TeeJet AI110025

- Medium drift
- 4-fold drift reduction

- X Coarse
30” Boom height, 14 mph

Airborne drift At 5 m (% of emitted)

- TurboTeeJet 11005
- TeeJet AI11004
- Venturi Nozzle, Low Boom, Slow Speed
- 2-fold drift reduction
We need to recover the cost of BMPs for our clients
Ran some more #Dicamba application hours for the month of JUNE per the new NoDak recs

3-9.99mph wind, under 85F, 7AM-9PM

Wishek- 12hrs
Berthold- 18hrs
Cooperstown- 19hrs
Carrington- 21hrs
Stephen, MN- 26hrs
Oakes- 32hrs
Prosper- 36hrs
Wahpeton- 36hrs
Campbell, MN- 40hrs

7:27 AM - 30 Nov 2017
8 Sprayer Average (450 engine hours/yr average)

ENGINE HOURS

- Spraying, 45%: 203 h
- Transport, 22%: 97 h
- Idling, 33%: 151 h

Sprayer Average (450 engine hours/yr average)
### Sprayer Config

<table>
<thead>
<tr>
<th>Units</th>
<th></th>
</tr>
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<tbody>
<tr>
<td>US</td>
<td>✓</td>
</tr>
<tr>
<td>Metric</td>
<td></td>
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#### Sprayer Information

<table>
<thead>
<tr>
<th>Tank Capacity: (US Gal)</th>
<th>800</th>
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<tbody>
<tr>
<td>Tank Remainder: (US Gal)</td>
<td>82</td>
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<td>Boom Width: (ft)</td>
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| Travel Speed: (mph)     | 18          |
| Volume: (gpa)           | 10          |
| Field Length: (mile)    | 0.5         |
| Headlands:              | 2           |
| Turn Speed: (mph)       | 8           |
| Time To Load: (min)     | 45          |
### Baseline

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30 min loading tank  
60 min cleaning tank  
Clean every 4 tanks  
= 15 minutes per tank  
TOTAL = 45 min/tank
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### OUTPUTS

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<thead>
<tr>
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<tbody>
<tr>
<td>Gross Productivity</td>
<td>218 ac/h</td>
</tr>
<tr>
<td>Productivity with turns</td>
<td>161 ac/h</td>
</tr>
<tr>
<td><strong>Net Productivity</strong></td>
<td>60 ac/h</td>
</tr>
<tr>
<td>Driving time lost to turns</td>
<td>26 %</td>
</tr>
<tr>
<td>Spraying lost to loading</td>
<td>63 %</td>
</tr>
<tr>
<td>Productivity lost</td>
<td>73 %</td>
</tr>
<tr>
<td>% of Baseline</td>
<td>100 %</td>
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</table>
Variable | Baseline  | Units |
--- | --- | --- |
Tank Capacity: | 800 | gal |
Tank Remainder: | 82 | gal |
Boom width: | 100 | ft |
**Travel Speed:** | 14 | mph |
Volume: | 10 | gpa |
Field length: | 0.5 | mile |
Headlands: | 2 | |
Turn speed: | 8 | mph |
Time to load & clean: | 45 | min |

---

**OUTPUTS**

- **Gross Productivity**: 170 ac/h
- **Productivity with turns**: 133 ac/h
- **Net Productivity**: 56 ac/h
- **Driving time lost to turns**: 22 %
- **Spraying lost to loading**: 58 %
- **Productivity lost**: 67 %
- **% of Baseline**: 93 %

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...& Slow
...& fast fill

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10 min loading tank
60 min cleaning tank
Clean every 4 tanks
= 15 minutes per tank
TOTAL = 25 min/tank
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<td><strong>Net Productivity</strong></td>
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Continuous internal sprayer rinsing

Regulator

Solution Pump

Sump

Clean Water Tank

Obtained from Joachim Herfort, Agrotop. Modified from Harald Kramer
Continuous Rinsing

We’ve recently been talking about how to save time while cleaning a sprayer. Although it’s very important to be thorough while cleaning, and to take the necessary time to do the job properly, there is always an opportunity to fine tune and spend less...Read More

Continuous Rinsing should be considered in North America

...& fast fill and fast clean

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Time to load & clean: 17.5 min

10 min loading tank
30 min cleaning tank
Clean every 4 tanks = 7.5 minutes per tank
TOTAL = 17.5 min/tank
...& fast fill and fast clean

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<td>144 %</td>
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Sensing Technology will buy us some time
1 m optical sensor, 5 nozzles, 8" channel width
“Weed Chipper”
University of Western Australia & University of Sidney
Dr. Andrew Guzzomi, Dr. Carlo Peressini, Dr. Michael Walsh
Learn more about spraying

Sprayers101

Jason Deveau
@spray_guy

Tom Wolf
@nozzle_guy

www.sprayers101.com