DRT Programs/ Modeling

Andrew Hewitt
Summary

- Canadian BZM scheme
- European DRT schemes
- Assessing the UK LERAP and German schemes independently from a NZ/ Australian perspective – the UK data appear to be optimal
- We need to collaborate internationally to share DRT data rather than re-testing in each country
“Typical Drift”: Aerial 2%, Orchard Airblast 0.5%, Ground 0.1%

Findings

Typical drift levels from aerial application

The goal of aerial applicators is to protect crops from diseases, insects and weeds while keeping drift as close to zero as possible. The SDTF studies show that drift can be kept very low by using good application procedures.

Based on data generated by the SDTF, in a typical full field aerial application, 98% of the total applied active ingredient stays on the field and only 2% drifts (figure 2). A typical application was defined as a 1200-foot wide, 20-swath field (suggested by EPA) using an Air Tractor 401® set-up to produce a medium droplet spectrum, in a 10 mph crosswind (typically the maximum allowable wind speed), a 60-foot swath adjustment, and 8-foot nozzle height (application height).

Average SDTF Control Application (90 replicates)

Cessna Ag Husky®
180 ft wide field
Medium spray

www.agdrift.com
Drift Reduction Technologies

- DRTs are a key part of our NZ research under objective 3 (technologies)
- DRTs are of high interest in Australia and North America
- Several countries already have DRT schemes in place – e.g. many European countries; new Canadian scheme
- The US and Australia are working on new DRT schemes
- Wind tunnel data (Europe) and Canadian field data assess drift reduction by reduction in airborne drift and in the case of Canada, not on ground deposition per se
DRTs currently being adopted

- Nozzles at specific pressures – European databases from wind tunnel work at TAG Silsoe, UK and JKI, Germany: Europe is already using these data and Canada wants to work with Australia (and possibly NZ) to co-ordinate requesting access for their/our use (rather than each country making its own separate request) – USA too?
- European data for tree and vine crop sprayers as well as air boom sprayers like the Hardi Twin
- GRDC sponsored testing at UQ for shields, which has been completed in wind tunnel and field
- Canada using Wolf data-shrouds/cones
More DRTs being used/ considered

- Barrier vegetation was considered in LERAP scheme but not used in most schemes yet. In NZ, hedges would be an excellent DRT option, given their common occurrence around tree and vine crops in particular.
- Dose rate is a DRT in European schemes – most labels give a range of rates, yet risk assessment tends to use only the highest rate.
- Water depth – the default reasonable worst-case water body is shallow – DRT depths greater.
LERAP (UK)

- Local Environmental Risk Assessment for Pesticides

### Table 3: Buffer zone reduction WITHOUT windbreak

<table>
<thead>
<tr>
<th>Applied Dose Sprayer type</th>
<th>Full Rate (75.1-100%)</th>
<th>3/4 Rate (50.1-75%)</th>
<th>1/2 Rate (25.1-50%)</th>
<th>1/4 Rate (0-25%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>14m</td>
<td>15m</td>
<td>12m</td>
<td>7m</td>
</tr>
<tr>
<td>LERAP Low drift 1 star</td>
<td>15m</td>
<td>12m</td>
<td>9m</td>
<td>5m</td>
</tr>
<tr>
<td>LERAP Low drift 2 star</td>
<td>12m</td>
<td>9m</td>
<td>6m</td>
<td>5m</td>
</tr>
<tr>
<td>LERAP Low drift 3 star</td>
<td>9m</td>
<td>6m</td>
<td>5m</td>
<td>5m</td>
</tr>
</tbody>
</table>

Example 2: Buffer Zone reduction for star-rated equipment for a product with an 18-metre buffer zone with windbreak.

### Table 4: Buffer zone reduction WITH windbreak

<table>
<thead>
<tr>
<th>Applied Dose Sprayer type</th>
<th>Full Rate (75.1-100%)</th>
<th>3/4 Rate (50.1-75%)</th>
<th>1/2 Rate (25.1-50%)</th>
<th>1/4 Rate (0-25%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>12m</td>
<td>9m</td>
<td>6m</td>
<td>5m</td>
</tr>
<tr>
<td>LERAP Low drift 1 star</td>
<td>9m</td>
<td>6m</td>
<td>5m</td>
<td>5m</td>
</tr>
<tr>
<td>LERAP Low drift 2 star</td>
<td>6m</td>
<td>5m</td>
<td>5m</td>
<td>5m</td>
</tr>
<tr>
<td>LERAP Low drift 3 star</td>
<td>5m</td>
<td>5m</td>
<td>5m</td>
<td>5m</td>
</tr>
<tr>
<td>Application by tunnel sprayer</td>
<td>5m</td>
<td>5m</td>
<td>5m</td>
<td>5m</td>
</tr>
<tr>
<td>Dry ditch connected to river system</td>
<td>5m</td>
<td>5m</td>
<td>5m</td>
<td>5m</td>
</tr>
</tbody>
</table>

### Officially Recognised LERAP Low Drift Rating Spray Equipment: Results

Your query is satisfied by 192 items

<table>
<thead>
<tr>
<th>Recognised Supplier</th>
<th>Recognised Item</th>
<th>At Pressure (Bars)</th>
<th>LERAP-Low Drift Rating</th>
<th>Links to Operational Settings and Conditions</th>
<th>Date accredited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuz (Saint-Gobain Ceramiques Desmarquest)</td>
<td>Albuz AVI air-induction nozzle AVI 110 02</td>
<td>3.0 - 5.0 bar</td>
<td>**</td>
<td>Get Details</td>
<td>15/04/2005</td>
</tr>
<tr>
<td>Albuz (Saint-Gobain Ceramiques Desmarquest)</td>
<td>Albuz AVI air-induction nozzle AVI 110 025</td>
<td>3.0 - 3.5 bar</td>
<td>***</td>
<td>Get Details</td>
<td>30/03/2005</td>
</tr>
<tr>
<td>Albuz (Saint-Gobain Ceramiques Desmarquest)</td>
<td>Albuz AVI air-induction nozzle AVI 110 025</td>
<td>4.0 - 5.0 bar</td>
<td>**</td>
<td>Get Details</td>
<td>30/03/2005</td>
</tr>
<tr>
<td>Albuz (Saint-Gobain Ceramiques Desmarquest)</td>
<td>Albuz AVI air-induction nozzle AVI 110 03</td>
<td>3.0 - 5.0 bar</td>
<td>**</td>
<td>Get Details</td>
<td>30/03/2005</td>
</tr>
<tr>
<td>Albuz (Saint-Gobain Ceramiques Desmarquest)</td>
<td>Albuz AVI air-induction nozzle AVI 110 04</td>
<td>3.0 - 5.0 bar</td>
<td>***</td>
<td>Get Details</td>
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</tr>
<tr>
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<td>Albuz AVI air-induction nozzle AVI 110 05</td>
<td>3.0 - 5.0 bar</td>
<td>***</td>
<td>Get Details</td>
<td>30/03/2005</td>
</tr>
</tbody>
</table>
Canadian Buffer Zone Multiplier

- New scheme introduced mid 2011
- Allows applicators to reduce certain labeled no-spray buffer zones if using DRTs
- Unlike the European schemes, it also includes aerial applications
- Ground DRTs based on published work from Wolf and others; plans to add European nozzle classifications
- Aerial DRTs based on AGDISP modeling
- Forms are completed online and then printed/ filed
Australian Vineyard Buffer Study
PIRSA/CPAS Different sprayers; different barriers

Comparison of Barrier Types

- concentration μg/L (Log scale)
- Distance from Barrier (m)

- artificial
- None
- Hedge
Buffer Zone Calculator

The Buffer Zone Calculator is an interactive tool that enables pesticide applicators to modify the size of the Buffer Zone (BZ) specified on a pesticide product label when spraying their fields. By combining information on current weather conditions and their sprayer configuration, applicators may find that BZ distances on product labels can be reduced.

Applicators that choose to use the Calculator to reduce their BZ will need to retain a copy of the BZ Summary page to demonstrate compliance with label directions. Records must be retained for at least one year following application.

Please have the following ready **before** using the Calculator:

- Product Label
- Windspeed
- Wind Direction
- Sprayer configuration
- Temperature (for aerial applications only)
- Relative Humidity (for aerial applications only)

**Information entered into the calculator is not stored or saved.**
If you leave the calculator application to gather needed information, when you return, you will have to re-enter the data.

**Please use the "Previous" and "Next" buttons when using the Calculator.**
If you use the forward and back buttons on your Internet browser, information entered may be lost.

[Start Using the BZ Calculator]

If you have any questions or would like to provide feedback to improve the BZ Calculator, please contact the Pest Management Information Service.
Consumer Product Safety

Site-Specific Buffer Zone Calculator

Profile
- Date: 2010-06-16
- Applicator and Business Name: Agri-Sprayers Inc.
- Applicator Certification No.: 10011101
- Land Description: Kuchnicki Acres, R.R. #1 Renfrew
- Crop and Growth Stage: Corn, 3rd Tiller
- Product Name: Killmound Herbicide
- PCP Registration No.: 10001
- Application Technique: Field Sprayer

Habitats for Buffer Zone Protection
Select all sensitive habitat types that are either within, or adjacent to your planned spray area.
- [ ] Freshwater body < 1 m deep (e.g., small pond, creek, seasonal wetland, etc.)
- [ ] Freshwater body > 1 m deep (e.g., large pond, lake, river, slough, permanent wetland, etc.)
- [ ] Marine water body < 1 m deep
- [ ] Marine water body > 1 m deep
- [ ] Terrestrial vegetation (e.g., shelterbelt, windbreak, forest, grasslands, etc.)

Meteorological Conditions (Field Sprayer)
- Application Start Time: 08:00
- Windspeed (km/h): 1-8
- Wind direction: North West - 315°
Field Sprayer Module

Buffer Zone on Label

- Freshwater habitat < 1 m deep: *
  - 60
- Freshwater habitat > 1 m deep: *
  - 20
- Terrestrial habitat: *
  - 25

Sprayer Configuration

- Equipment type: *
  - Standard boom sprayer
- Spray Quality on Label: *
  - Medium
- Spray Quality at Application: *
  - Coarse
- Boom height (m): *
  - 0.5
- Product application rate: *
  - 1.5 L/ha
- Carrier (water) volume (L/ha): *
  - 200 L/ha
- Nozzle: *
  - Turbo TeeJet TT11002
- Nozzle flow rate (L/minute): *
  - 0.4
- Boom pressure: *
  - 40 psi
- Tractor speed: *
  - 10 km/h
Site-Specific Sprayer Buffer Zones

- Freshwater habitat < 1 m deep: 6
- Freshwater habitat > 1 m deep: 2
- Terrestrial habitat: 3

Revisit your information

Print or Save your Results

These are the buffer zones that can now be used according to the application conditions you have specified in this calculator. Buffer zones are for habitats downstream of your spraying area only. You must retain a copy of this output for your files for at least one year from the time of application.

Help on accessing alternative formats, such as Portable Document Format (PDF), Microsoft Word and PowerPoint (PPT) files, can be obtained in the alternate format help section.

Revisit your information

Profile

Date: 2010-06-16
Applicator and Business Name: Agri-Sprayers Inc.
Land Description: Kuchnicki Acres, R.R. #1 Renfrew ON, Lot#3
Crop and growth stage: Corn, 3rd Tiller
Product Name: Kilometic Herbicide
PCP Registration No.: 10001
Application Technique: field
# Record of Site-Specific Buffer Zone Modifications

**Applicator and Business Name:** Agri-Sprayers Inc.

**Land Description:** Kuchnicki Acres, R.R. #1 Renfrew ON, Lot#3

**Crop and growth stage:** Corn, 3rd Tiller

**Product Name:** Killedead Herbicide, Registration No.: 10001

**Application Date:** 2010-06-16

**Application Technique:** field

## Buffer Zones from Product Label

<table>
<thead>
<tr>
<th>Type</th>
<th>Zone 1</th>
<th>Zone 2</th>
<th>Zone 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshwater body</td>
<td>less than 1 m deep</td>
<td>60 m</td>
<td>greater than 1 m deep</td>
</tr>
<tr>
<td>Marine water body</td>
<td>less than 1 m deep</td>
<td>greater than 1 m deep</td>
<td></td>
</tr>
<tr>
<td>Terrestrial area</td>
<td>25 m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Spayer Configuration

<table>
<thead>
<tr>
<th>Equipment/Sprayer type</th>
<th>Nozzle type</th>
<th>Turbo TeeJet TT11002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>Carrier (water) volume</td>
<td>200 L/ha L/ha</td>
</tr>
<tr>
<td>Nozzle deflection (aerial only)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## ASAE Spray Quality

<table>
<thead>
<tr>
<th>On Product Label:</th>
<th>At Application:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>Coarse</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Boom pressure</th>
<th>Boom height</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 psi</td>
<td>0.3 m</td>
</tr>
</tbody>
</table>

## Meteorological Conditions

<table>
<thead>
<tr>
<th>Start time</th>
<th>Wind speed</th>
<th>Direction</th>
<th>Temperature (aerial only)</th>
<th>Relative humidity (aerial only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00</td>
<td>1.8 km/h</td>
<td>North West</td>
<td>Relative humidity</td>
<td>Relative humidity</td>
</tr>
</tbody>
</table>

## Your Modified Site-Specific Buffer Zones

<table>
<thead>
<tr>
<th>Type</th>
<th>Zone 1</th>
<th>Zone 2</th>
<th>Zone 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshwater body</td>
<td>less than 1 m deep</td>
<td>6 m</td>
<td>greater than 1 m deep</td>
</tr>
<tr>
<td>Marine water body</td>
<td>less than 1 m deep</td>
<td>greater than 1 m deep</td>
<td></td>
</tr>
<tr>
<td>Terrestrial area</td>
<td>3 m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2010-06-16 - 11:10
More on European Data

- Germany uses Lurmark 11003 as reference nozzle (original BCPC reference)
- UK uses Teejet 11003 as reference nozzle
- These are >10% different which then produces differences in classification of DRT nozzles in the UK and Germany
Cumulative Spray Volume (%) / %

<table>
<thead>
<tr>
<th>Tank mix</th>
<th>Distance</th>
<th>Nozzle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>15 cm</td>
<td>Lurmark 11003</td>
</tr>
</tbody>
</table>
Test Substance

- Germany uses water as the test material which is not appropriate for air induction nozzles
- UK uses water + 0.1% surfactant as the test material
- Tests at UQ revealed large differences between water, water+Agral and water+2,4-D
Tank mix | Distance | Nozzle
---|---|---
Water | 15 cm | XR1104
Water + 0.1% Agrand | 15 cm | XR1104
Water + 0.4% Dioweed | 15 cm | XR1104
Water | 15 cm | XR1105
Water + 0.1% Agrand | 15 cm | XR1105
Water + 0.4% Dioweed | 15 cm | XR1105
Water | 15 cm | AIXR1
Water + 0.1% Agrand | 15 cm | AIXR1
Water + 0.4% Dioweed | 15 cm | AIXR1
Water | 15 cm | AIXR1
Water + 0.1% Agrand | 15 cm | AIXR1
Water + 0.4% Dioweed | 15 cm | AIXR1
Water | 15 cm | AI1100
Water + 0.1% Agrand | 15 cm | AI1100
Water + 0.4% Dioweed | 15 cm | AI1100
Water | 15 cm | DR110
Water + 0.1% Agrand | 15 cm | DR110
Water + 0.4% Dioweed | 15 cm | DR110
Water | 15 cm | DR110
Water + 0.1% Agrand | 15 cm | DR110
Water + 0.4% Dioweed | 15 cm | DR110
Water | 15 cm | MR800
Water + 0.1% Agrand | 15 cm | MR800
Water + 0.4% Dioweed | 15 cm | MR800
Examples of Sprays that Germany Classified in Same DRT Category (50%) versus 75% in UK
(These are only a few from among many such discrepancies)

- Teejet 11005 at 3 versus 4 bar (UK 75% at 3 bar)
- Teejet 110025 at 2 versus 3 bar (UK 75% at 2 bar)
- Teejet AIC series at 2 versus 3-5 bar (UK 75% at 2 bar)
- Hardi Minidrift series at 1-1.5 versus >1.5 bar (UK 75% at lower pressures)
- Teejet TTI series at all pressures – UK 75%
- Many others
Cumulative Spray Volume (%) / %

<table>
<thead>
<tr>
<th>Tank mix</th>
<th>Distance</th>
<th>Nozzle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>15 cm</td>
<td>AIC11003</td>
</tr>
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<td>15 cm</td>
<td>AIC11003</td>
</tr>
<tr>
<td>Water</td>
<td>15 cm</td>
<td>AIC11003</td>
</tr>
</tbody>
</table>

Droplet Diameter / µm

- Dv0.1 µm: 267, 267, 260
- VMD µm: 545, 541, 527
- Dv90 µm: 850, 832, 810
- V<150 %: 2.05, 2.12, 2.29
- V<100 %: 0.59, 0.63, 0.68
Aerial DRTs: US, CA, AU, NZ

1. “Drop” (Lowered) Boom System

- Lower the aircraft boom after takeoff
- Studies suggest drift may be reduced by ~60%
2. Vortex Mitigation Technologies
Fixed-Wing Aircraft Wakes
Helicopter Wakes
3. Wing Tip Modification Devices
(John Spillman)

- Modeling suggests drift may be reduced by 50 - 75% using wing tip sails
Reverse Venturi Chamber
(Russ Stocker)

- Reduces effective air velocity to ~half aircraft speed, allowing coarser sprays at higher flight speeds
Other DRTs

- Non-volatile rate and evaporation reduction
Spray Block Width

- AgDRIFT ground model default field width is 274 m
- Spraying fewer swaths reduces the drift loading – can reduce the no-spray buffer zone for 2,4-D by 75%
Example of 2,4-D Rate Reduction from 1.4 to 0.7kg/ha Giving Half the Buffer for LOC=1.4g/ha
Conclusions

- Recommend that we use the LERAP (UK) DRT data for nozzles, working with Canada to request joint access
- Recommend the Canadian approach of assessing DRTs based on reductions in airborne drift, sampled using field lasers (if field studies in October validate this approach) where data are for input to AGDISP/ WTDISP
- Need to agree on the reference systems – what are we reducing drift *from* as the baseline? ISO probably best
- Recommend collaboration between our countries on data sharing for DRT research and also models and calculators