DRT Programs/ Modeling

Andrew Hewitt

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Creating intelligent technologies for land and water based industries

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

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“Typical Drift”: Aerial 2%, Orchard Airblast 0.5%, Ground 0.1%

Findings

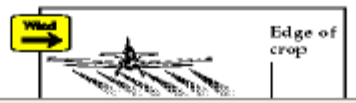
Typical drift levels from aerial application

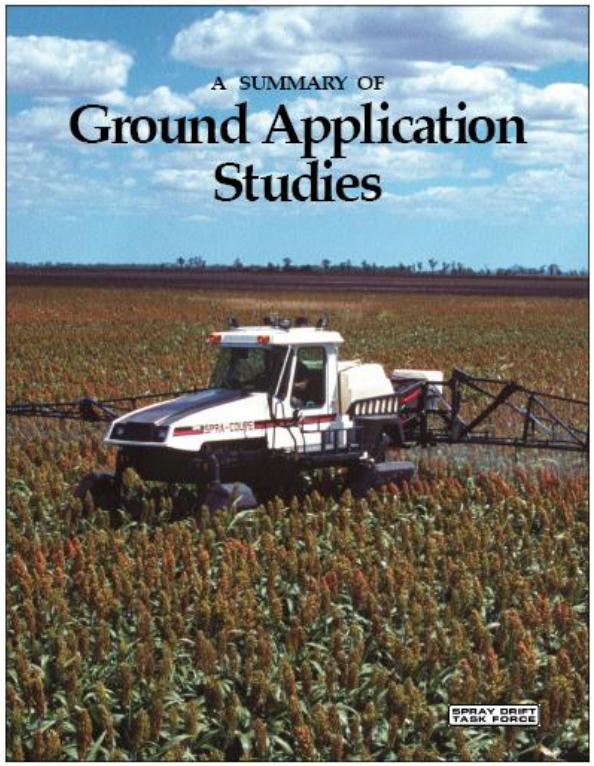
The goal of aerial applicators is to protect crops from diseases, insects and weeds while keeping drift as close to zero as possible. The SDTF studies show that drift can be kept very low by using good application procedures.

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

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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

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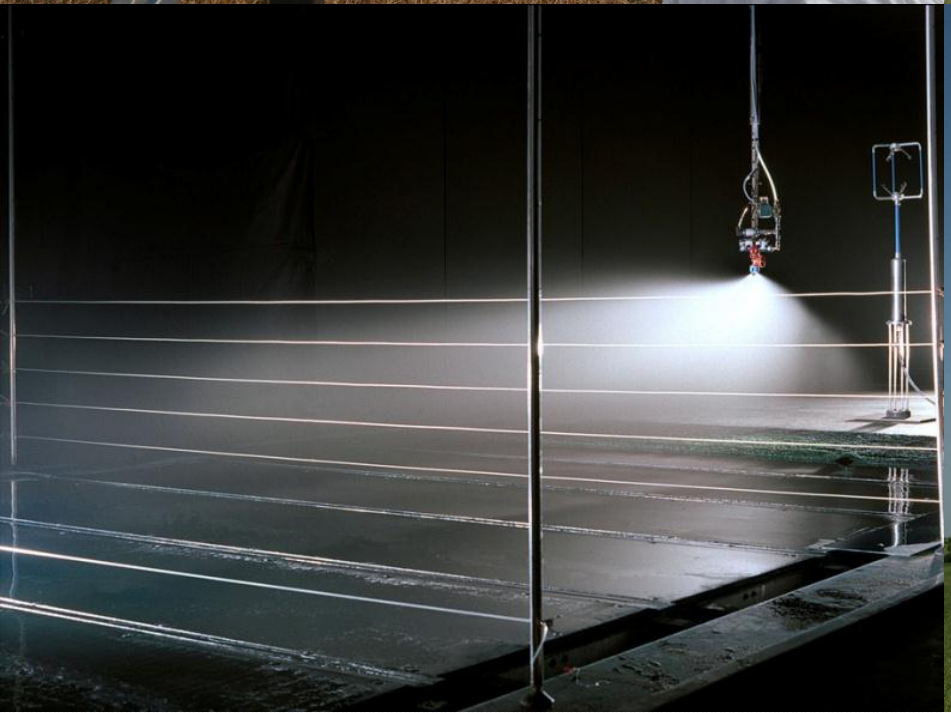

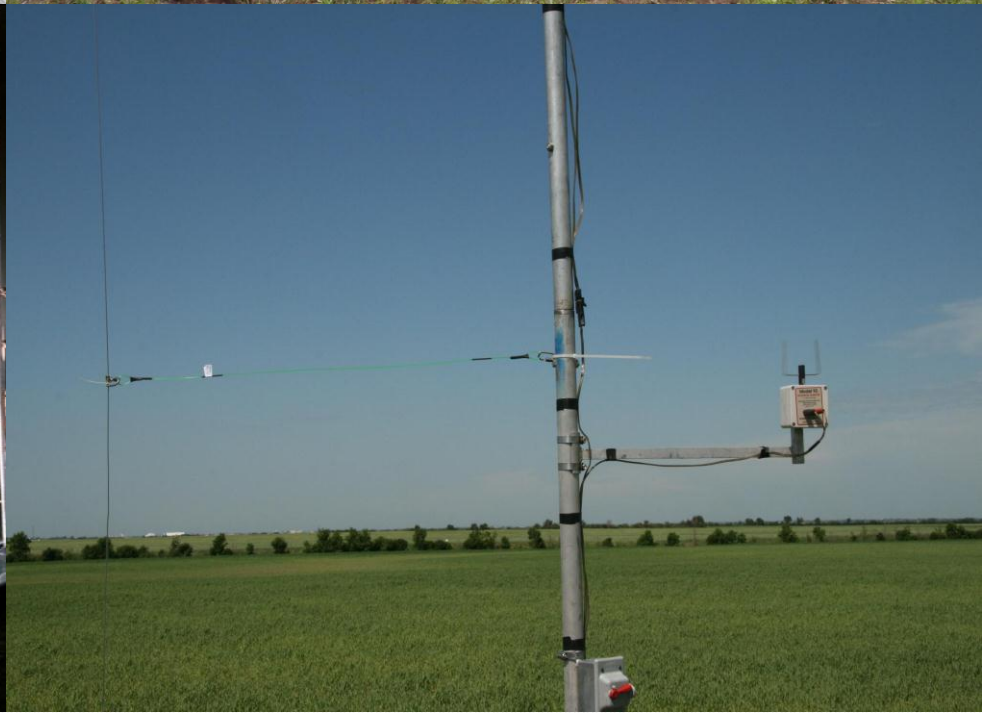

DRTs currently being adopted

- 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
-

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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

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LERAP (UK)

- Local Environmental Risk Assessment for Pesticides

Table 3 Buffer zone reduction WITHOUT windbreak

Applied Dose / Sprayer type	Full Rate (75.1-100%)	3/4 Rate (50,1-75%)	1/2 Rate (25.1-50%)	1/4 Rate (0-25%)
Standard	18m	15m	12m	7m
LERAP Low drift **1 star**	15m	12m	9m	5m
LERAP Low drift **2 star**	12m	9m	6m	5m
LERAP Low drift **3 star**	9m	6m	5m	5m

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

As with Table 3, this table shows what width you can reduce your buffer zone **to.**

Table 4 Buffer zone reduction WITH windbreak

Applied Dose / Sprayer type	Full Rate (75.1-100%)	3/4 Rate (50,1-75%)	1/2 Rate (25.1-50%)	1/4 Rate (0-25%)
Standard	12m	9m	6m	5m
LERAP Low drift **1 star**	9m	6m	5m	5m
LERAP Low drift **2 star**	6m	5m	5m	5m
LERAP Low drift **3 star**	5m	5m	5m	5m
Application by tunnel sprayer	5m	5m	5m	5m
Dry ditch connected to river system	5m	5m	5m	5m

Officially Recognised LERAP Low Drift Rating Spray Equipment: Results

Your query is satisfied by **192** items

Recognised Supplier	Recognised Item	At Pressure (Bars)	LERAP-Low Drift Rating	Links to Operational Settings and Conditions	Date accredited
Albuz (Saint-Gobain Ceramiques Desmarquest)	Albuz AVI air-induction nozzle AVI 110 02	3.0 - 5.0 bar	★★	Get Details	15/04/2005
Albuz (Saint-Gobain Ceramiques Desmarquest)	Albuz AVI air-induction nozzle AVI 110 025	3.0 - 3.5 bar	★★★	Get Details	30/03/2005
Albuz (Saint-Gobain Ceramiques Desmarquest)	Albuz AVI air-induction nozzle AVI 110 025	4.0 - 5.0 bar	★★	Get Details	30/03/2005
Albuz (Saint-Gobain Ceramiques Desmarquest)	Albuz AVI air-induction nozzle AVI 110 03	3.0 - 5.0 bar	★★	Get Details	30/03/2005
Albuz (Saint-Gobain Ceramiques Desmarquest)	Albuz AVI air-induction nozzle AVI 110 04	3.0 - 5.0 bar	★★★	Get Details	30/03/2005
Albuz (Saint-Gobain Ceramiques	Albuz AVI air-induction nozzle AVI 110 05	3.0 - 5.0 bar	★★★	Get Details	30/03/2005

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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

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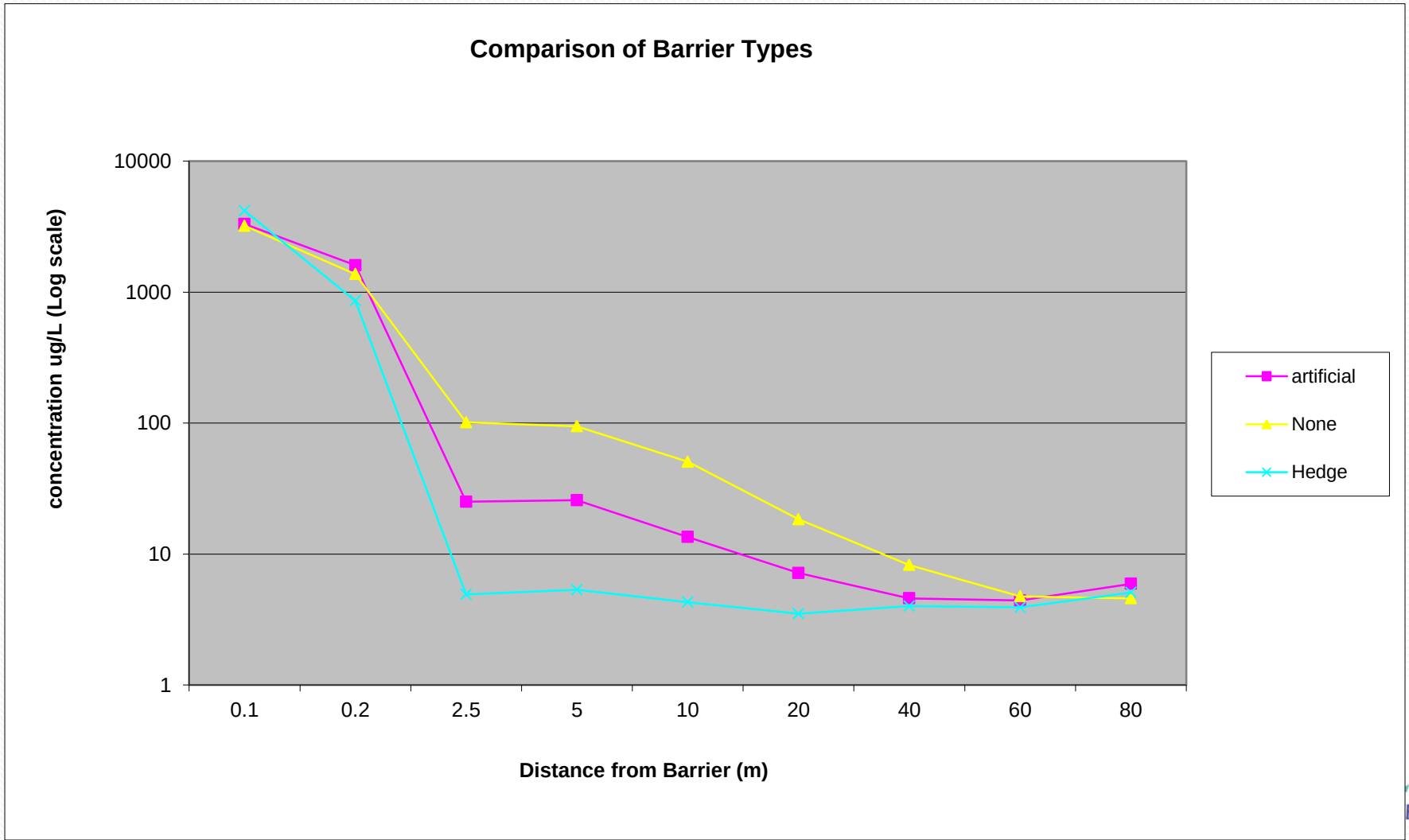
Australian Vineyard Buffer Study
PIRSA/ CPAS Different sprayers; different barriers



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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:

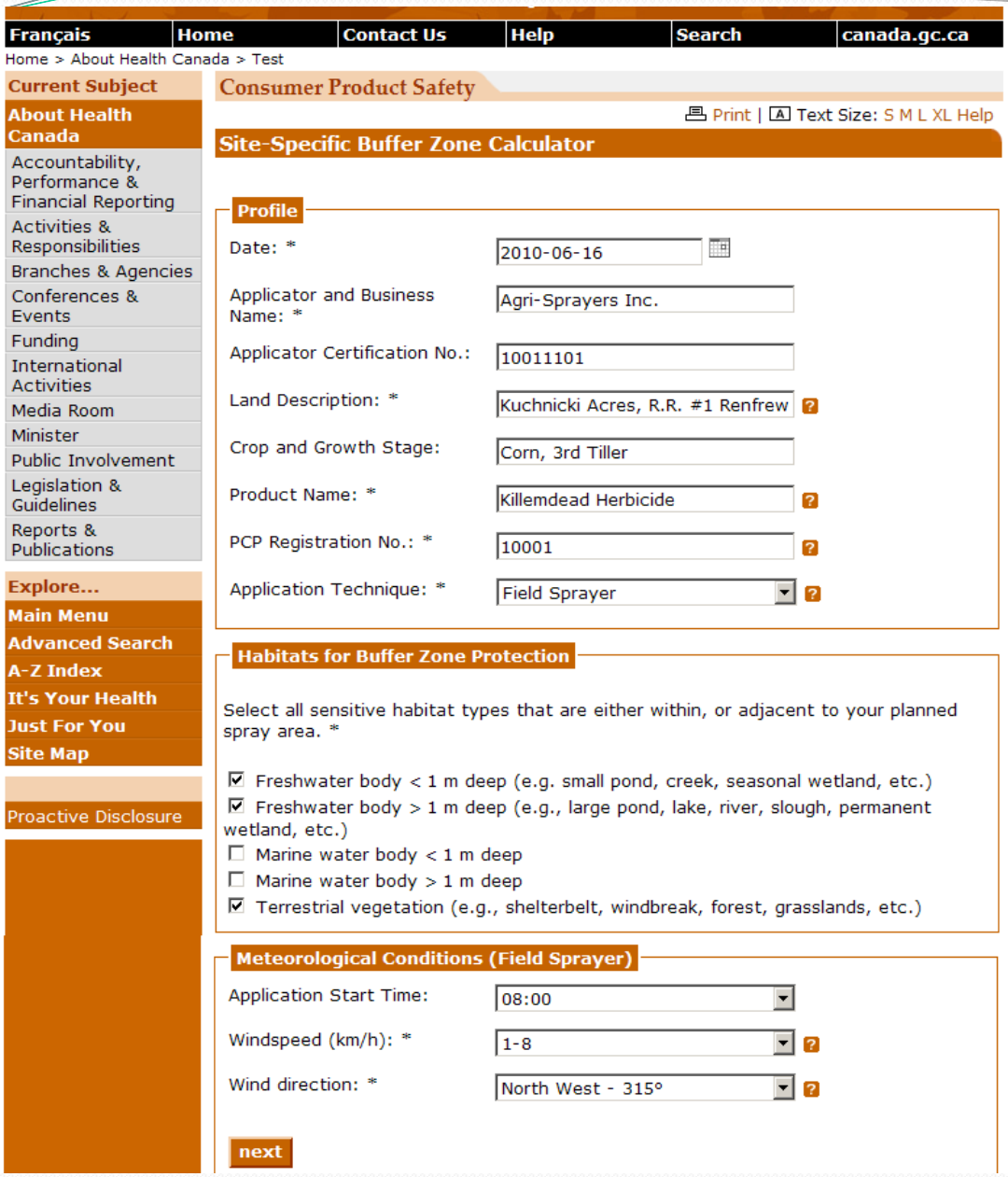
- Product Label
- Windspeed
- Wind Direction
- Sprayer configuration
- Temperature (*for aerial applications only*)
- Relative Humidity (*for aerial applications only*)

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.



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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

next

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Your Results

Site-Specific Sprayer Buffer Zones

Freshwater habitat < 1 m deep: 6

Freshwater habitat > 1 m deep: 2

Terrestrial habitat: 3

Revise 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 downwind 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.

(PDF Version - 3 K)

Revise your information

Page 1

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: Killemdead Herbicide
PCP Registration No.: 10001
Application Technique: field

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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	Killemdead Herbicide	**Registration No.**	10001
Application Date	2010-06-16	**Application Technique**	field
Application notes:			

Buffer Zones from Product Label

Freshwater body	less than 1 m deep	60 m	greater than 1 m deep	20 m
Marine water body	less than 1 m deep		greater than 1 m deep	
Terrestrial area		25 m		

Spayer Configuration

Equipment/Sprayer type	Standard	**Nozzle type**	Turbo TeeJet TT11002
Nozzle deflection (aerial only)		**Carrier (water) volume**	200 L/ha L/ha
Product application rate	1.5 L/ha L/ha or g/ha		
ASAE Spray Quality			
On Product Label:	Medium	**At Application:**	Coarse
Boom pressure	40 psi	**Boom height**	0.5 m
Tractor speed or Air speed	10 km/h		

Meteorological Conditions

Start time	08:00	**Wind speed**	1-8 km/h	**Direction**	North West
Temperature (aerial only)			**Relative humidity (aerial only)**		

Your Modified Site-Specific Buffer Zones

Freshwater body	less than 1 m deep	6 m	greater than 1 m deep	2 m
Marine water body	less than 1 m deep		greater than 1 m deep	
Terrestrial area		3 m		

2010-06-08 - 11:10

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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

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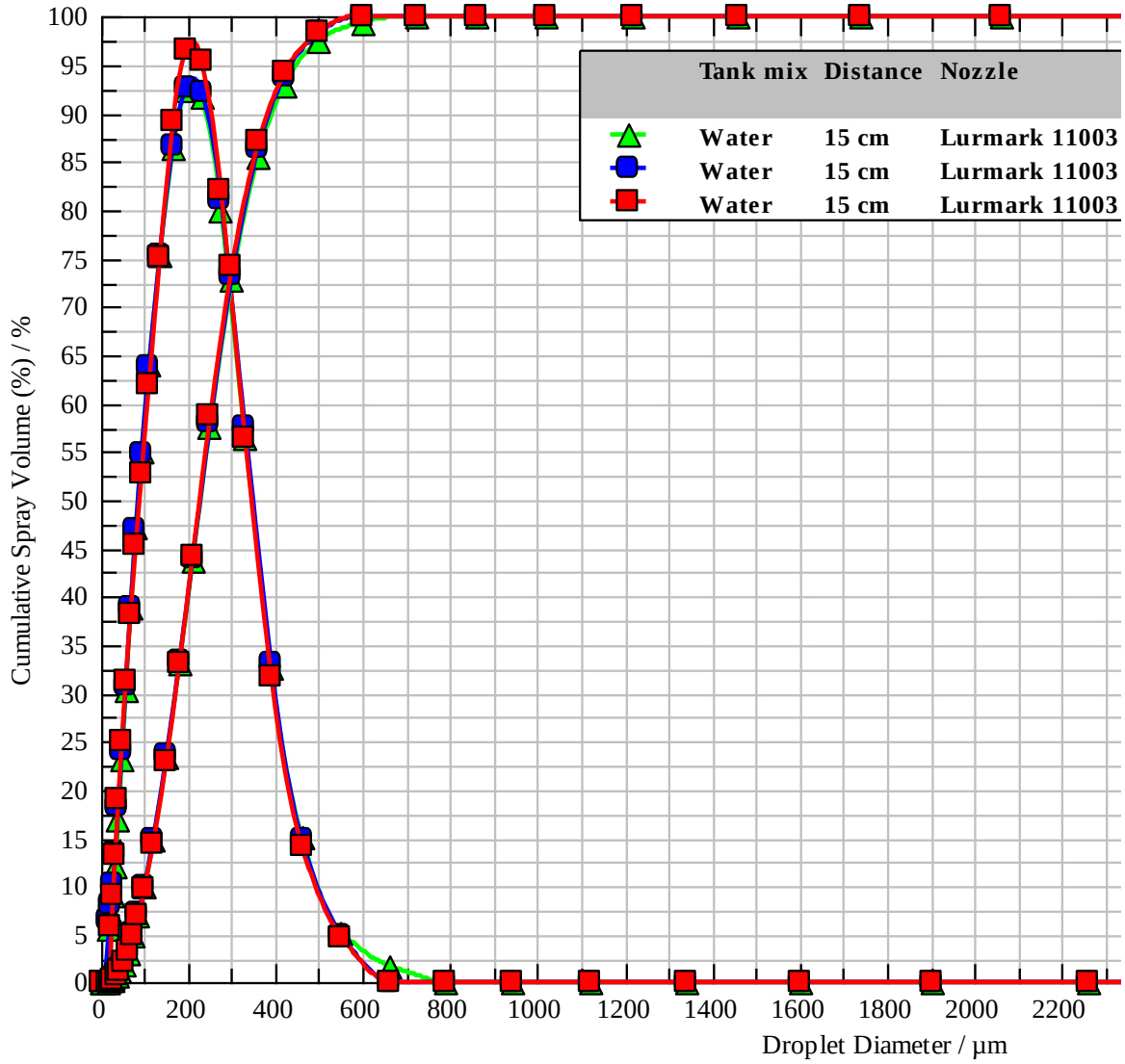
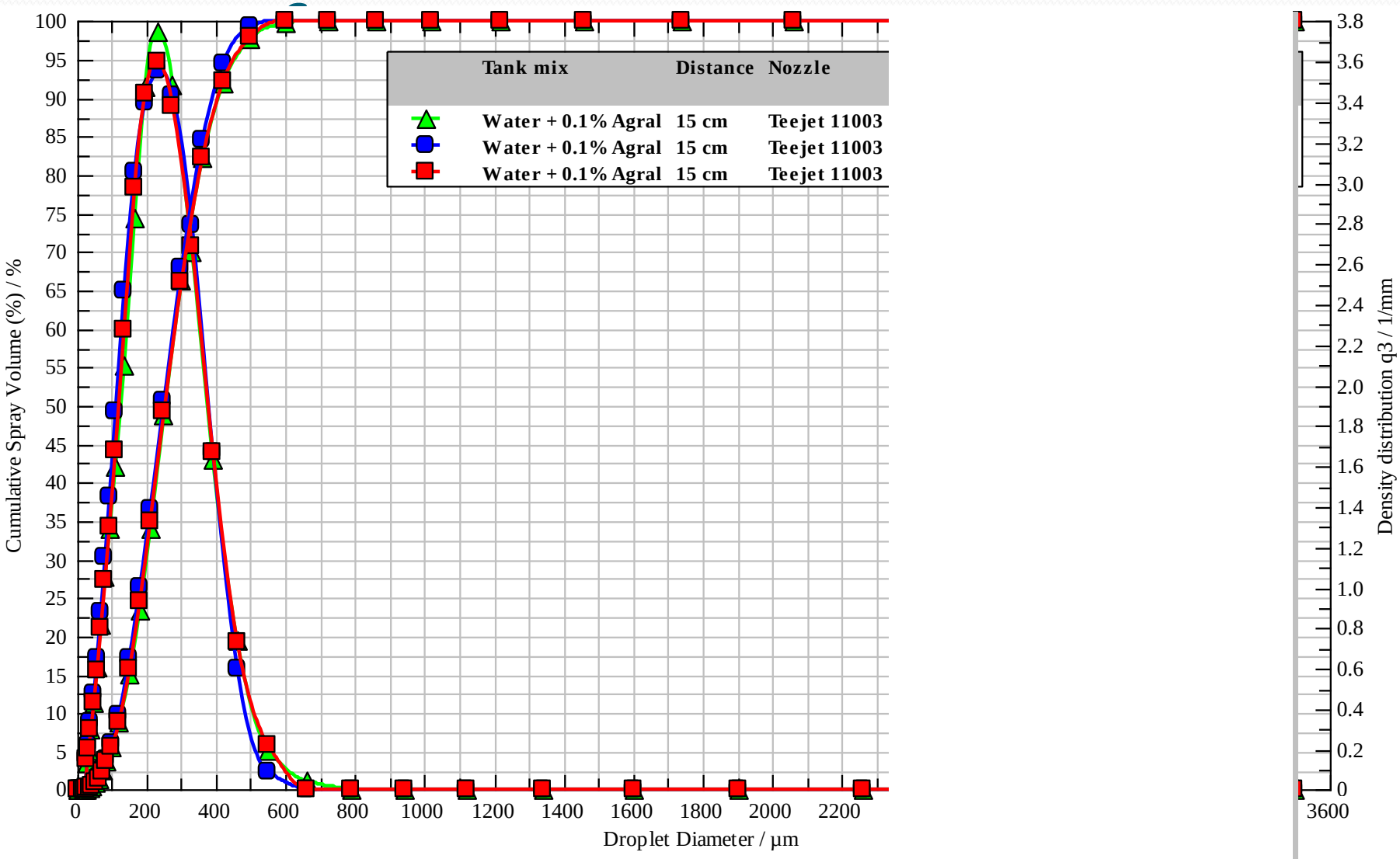

Tank mix Distance Nozzle
Water 15 cm Lurmark 11003
Water 15 cm Lurmark 11003
Water 15 cm Lurmark 11003
Cumulative Spray Volume (%) / %
Droplet Diameter / µm
Density distribution q3 / 1/mm
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
0 200 400 600 800 1000 1200 1400 1600 1800 2000 2200

LIMITED


Tank mix
Distance
Nozzle
Water + 0.1% Agral
15 cm
Teejet 11003
Water + 0.1% Agral
15 cm
Teejet 11003
Water + 0.1% Agral
15 cm
Teejet 11003
Cumulative Spray Volume (%) / %
Droplet Diameter / µm
Density distribution q3 / 1/mm
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
3600
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8

LIMITED

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

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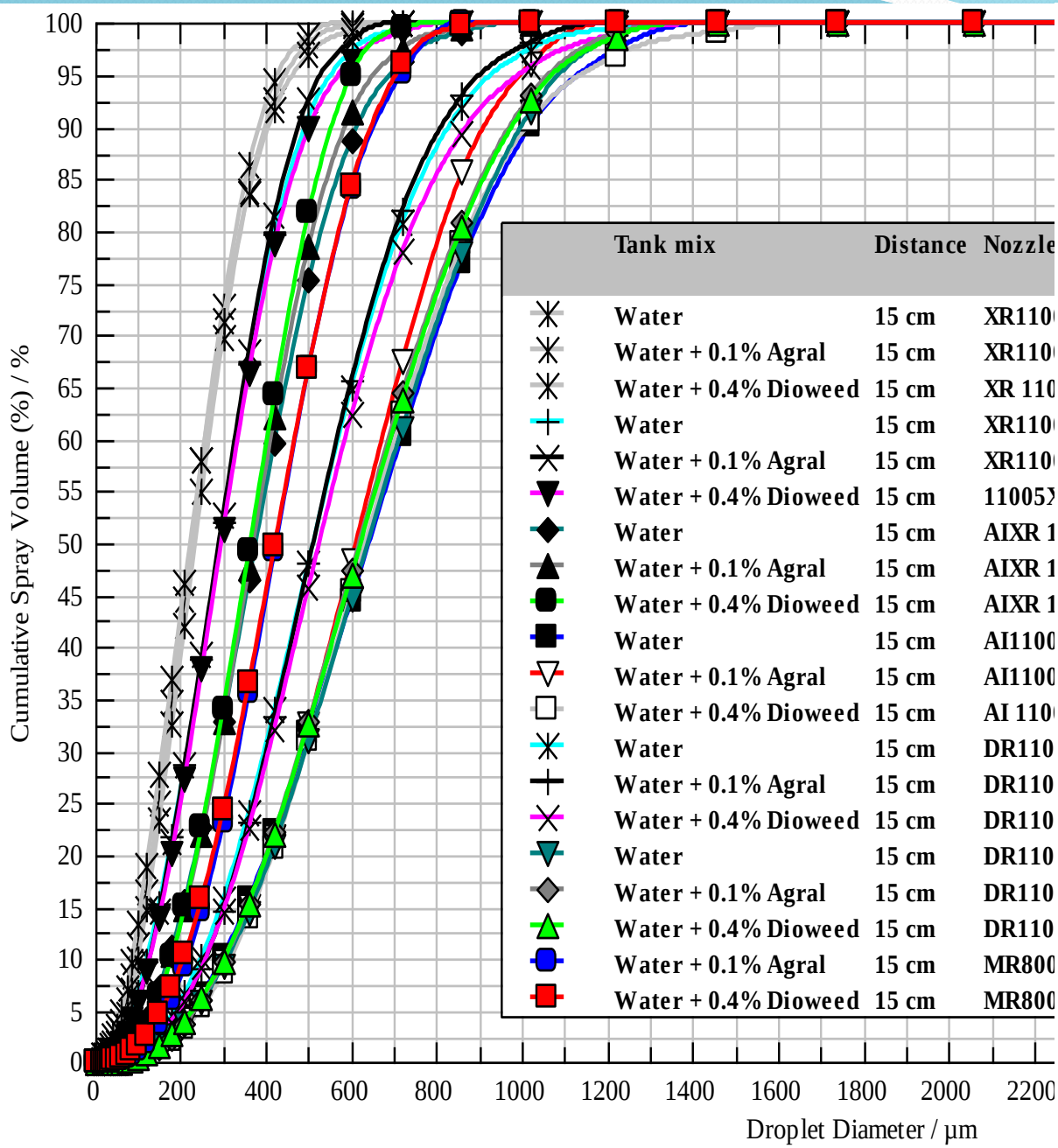
Cumulative Spray Volume (%) / %
Droplet Diameter / µm
0
5
10
15
20
25
30
35
40
45
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55
60
65
70
75
80
85
90
95
100
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
Tank mix
Distance
Nozzle
Water 15 cm XR110
Water + 0.1% Agral 15 cm XR110
Water + 0.4% Dioweed 15 cm XR 110
Water 15 cm XR110
Water + 0.1% Agral 15 cm XR110
Water + 0.4% Dioweed 15 cm 11005
Water 15 cm AIXR 1
Water + 0.1% Agral 15 cm AIXR 1
Water + 0.4% Dioweed 15 cm AIXR 1
Water 15 cm AI1100
Water + 0.1% Agral 15 cm AI1100
Water + 0.4% Dioweed 15 cm AI 110
Water 15 cm DR110
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Water + 0.4% Dioweed 15 cm DR110
Water 15 cm DR110
Water + 0.1% Agral 15 cm DR110
Water + 0.4% Dioweed 15 cm DR110
Water + 0.1% Agral 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

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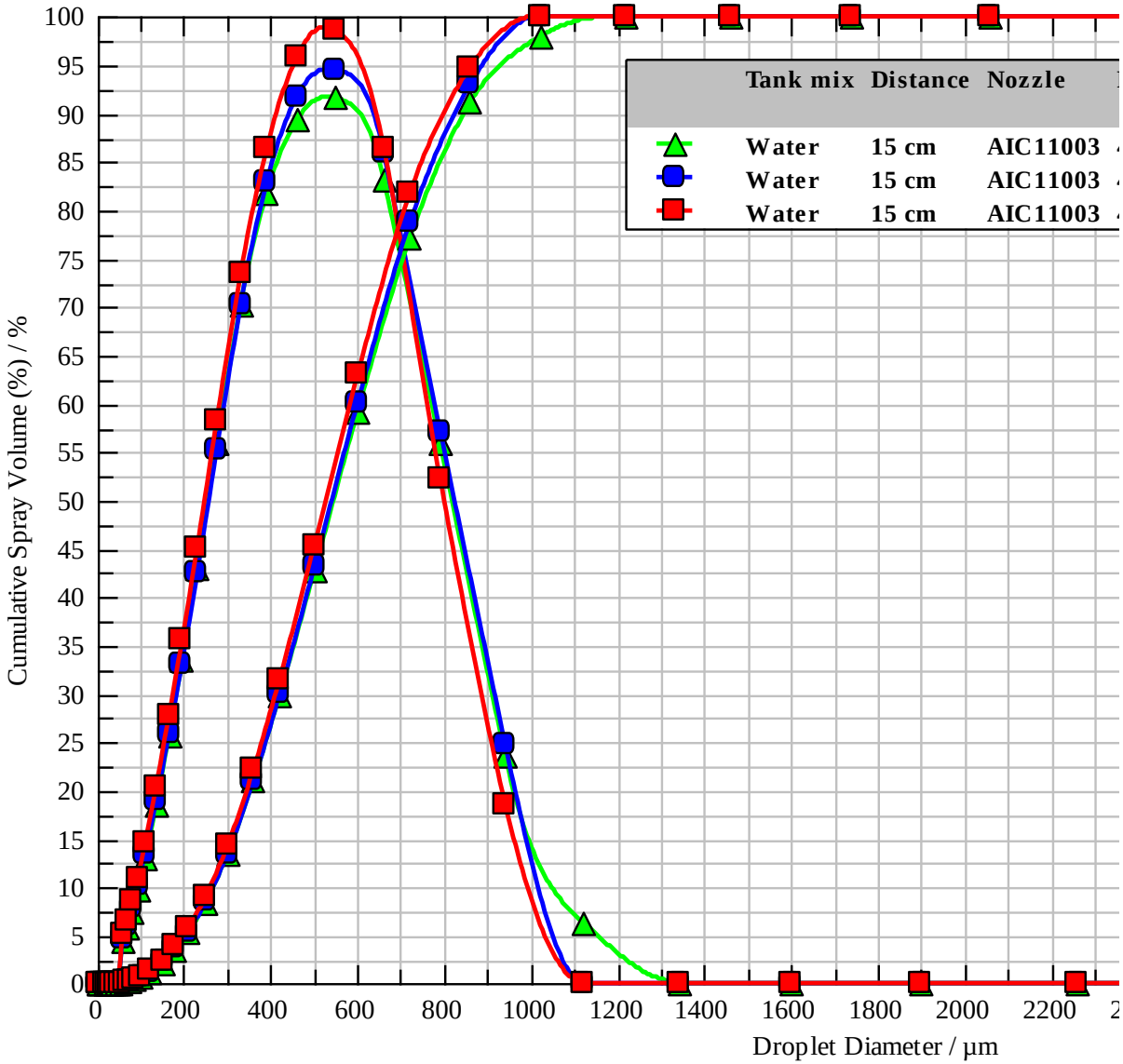

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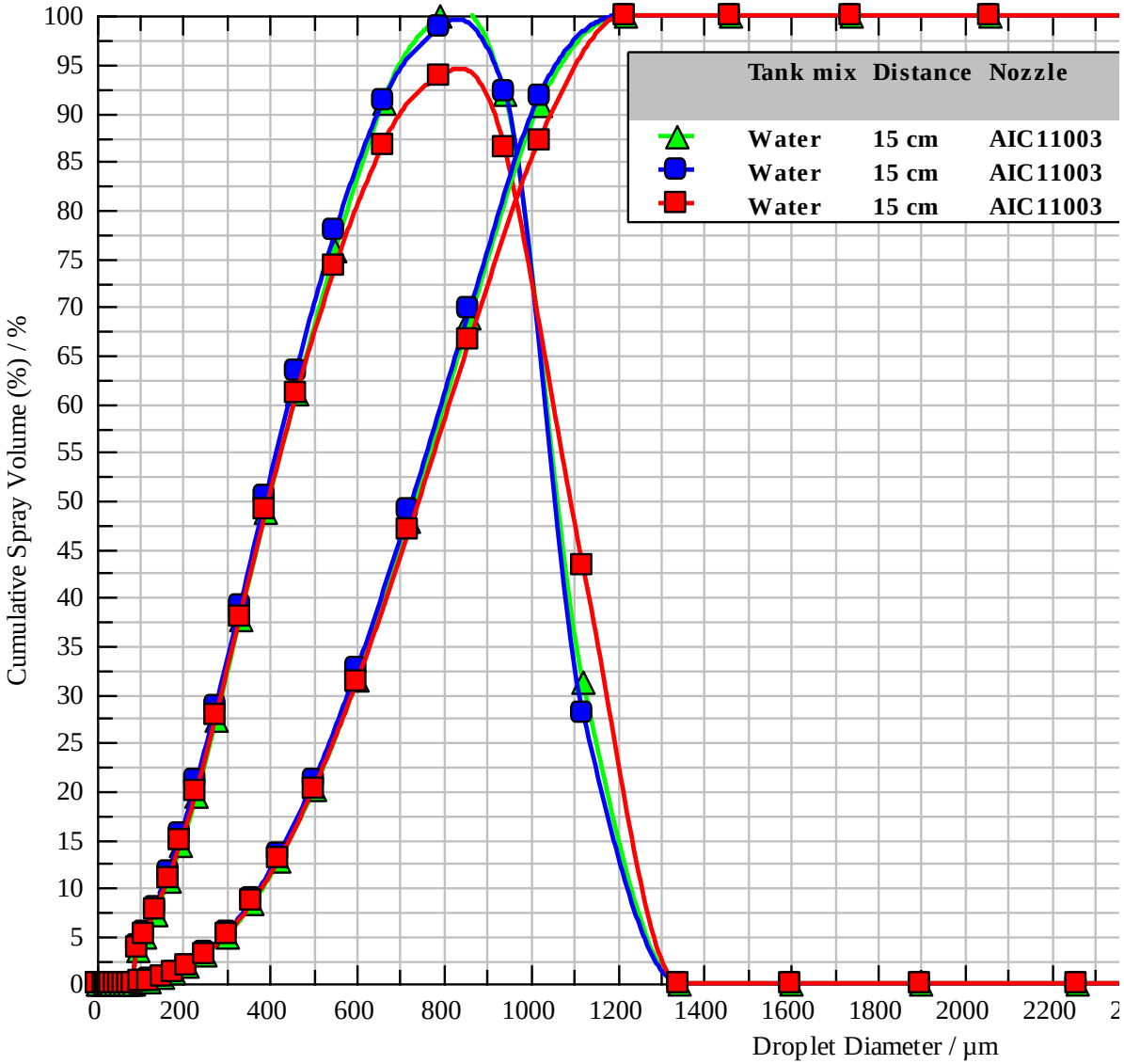

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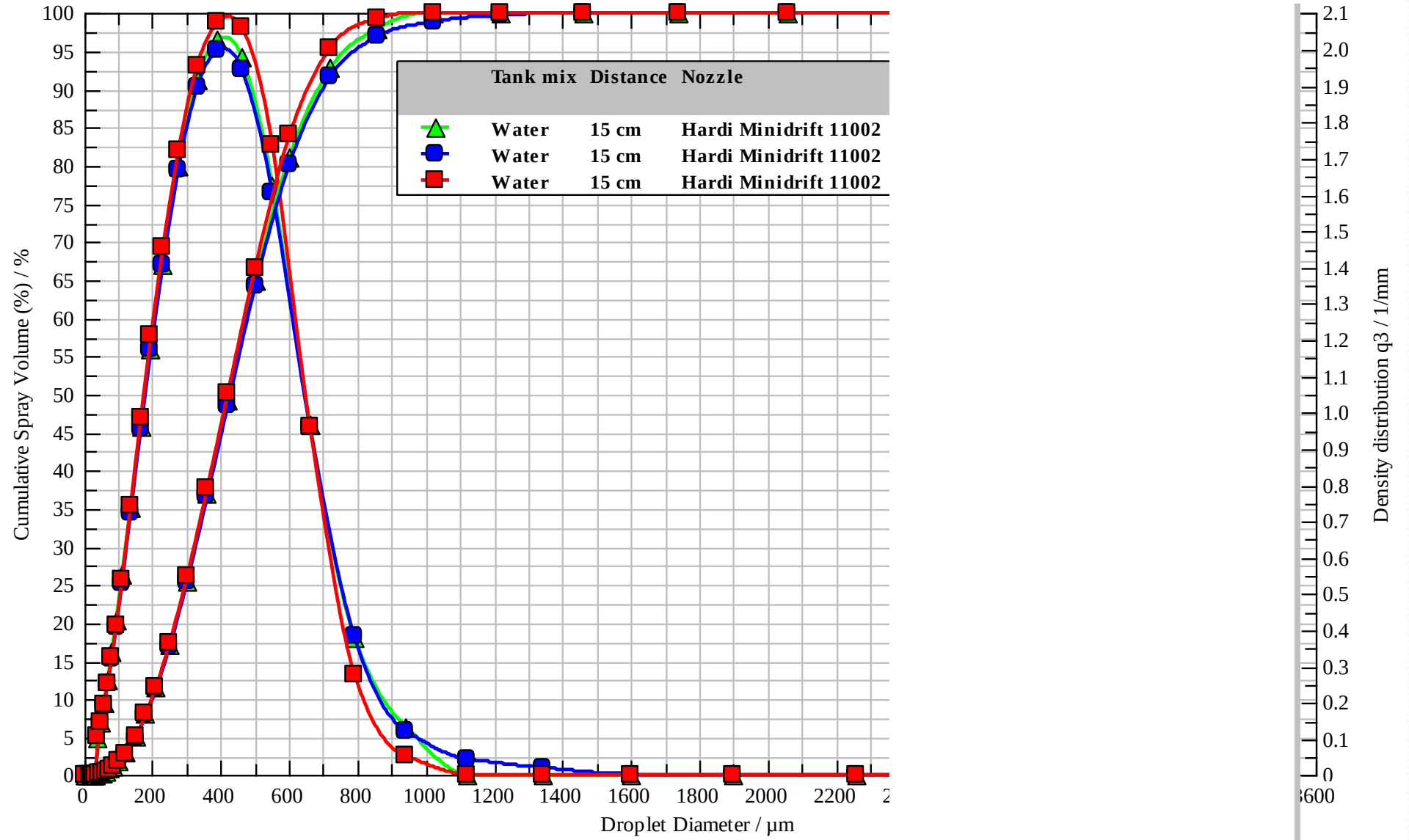

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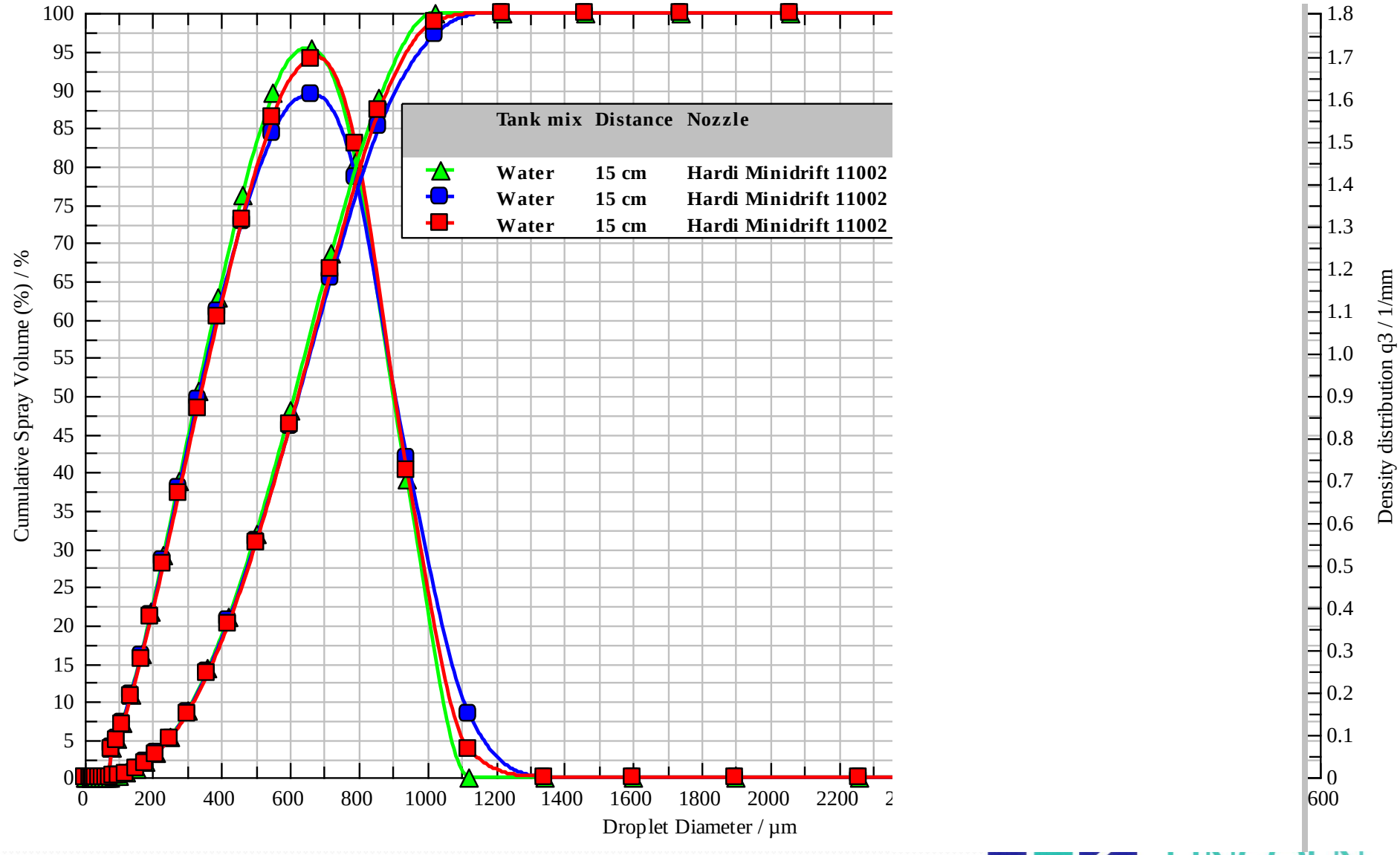

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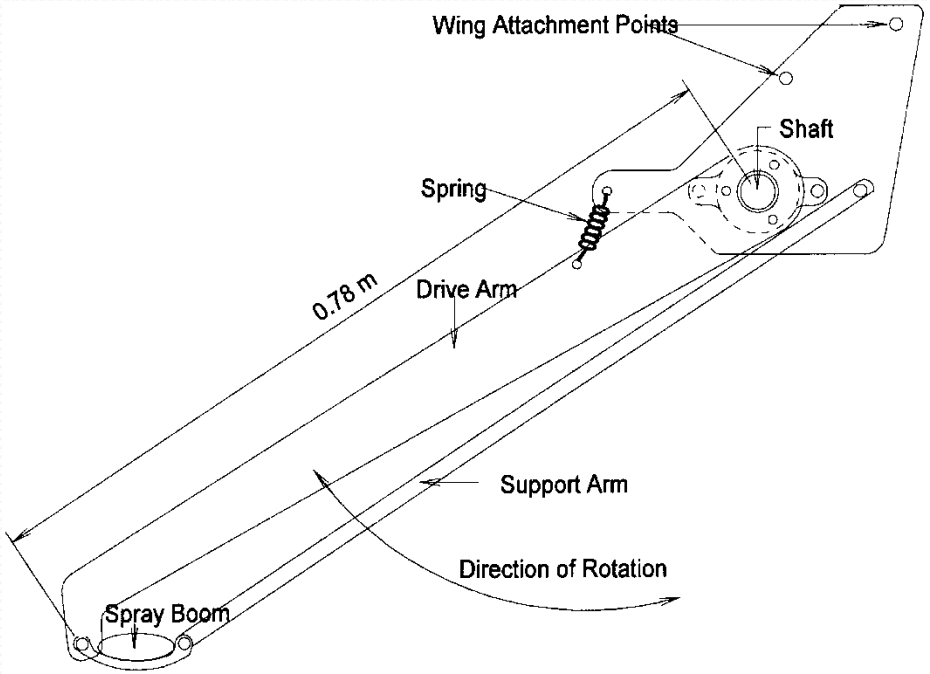
Aerial DRTs: US, CA, AU, NZ

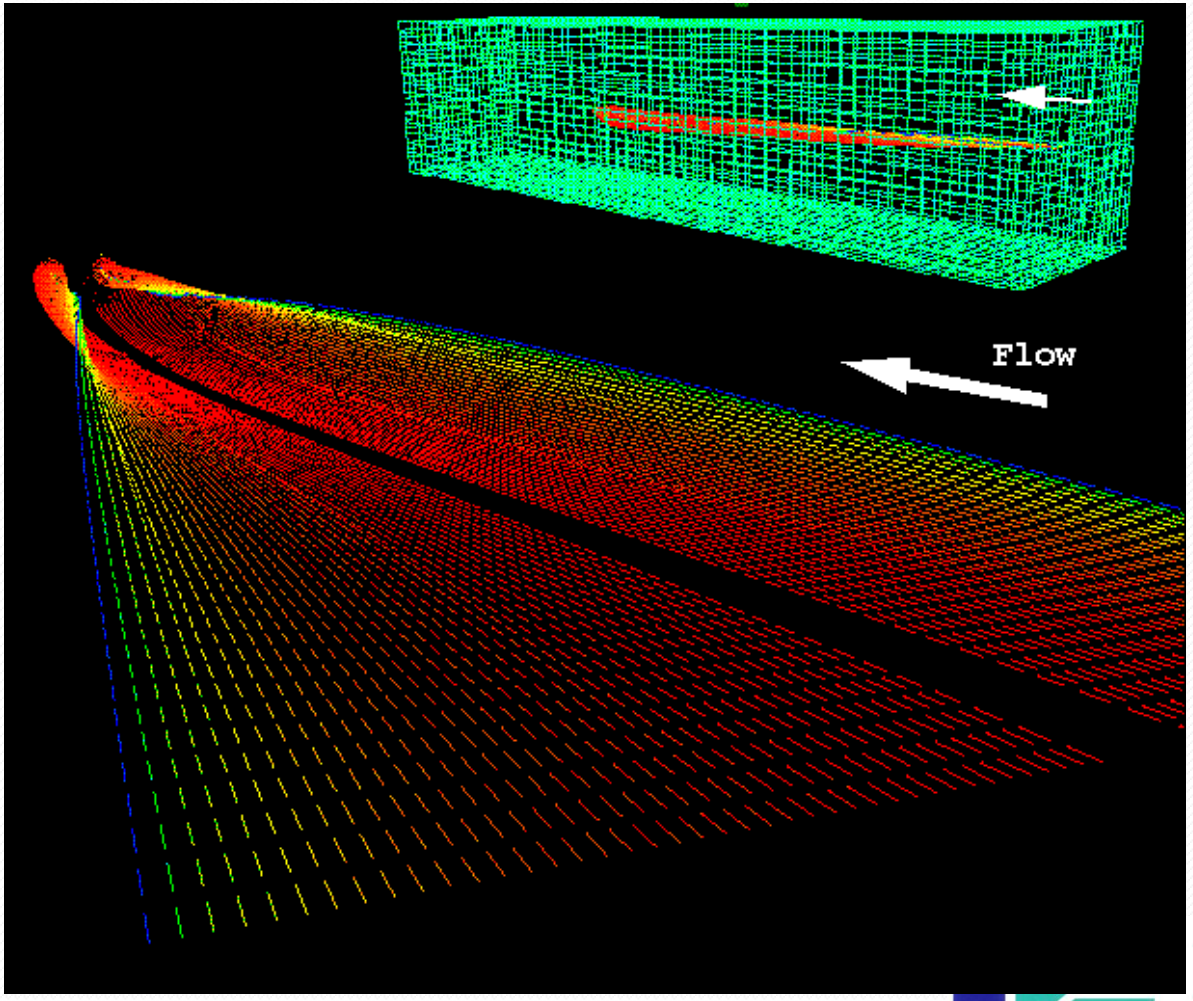
1. “Drop” (Lowered) Boom System

- Lower the aircraft boom after takeoff
- Studies suggest drift may be reduced by ~60%



2. Vortex Mitigation Technologies

Fixed-Wing Aircraft Wakes



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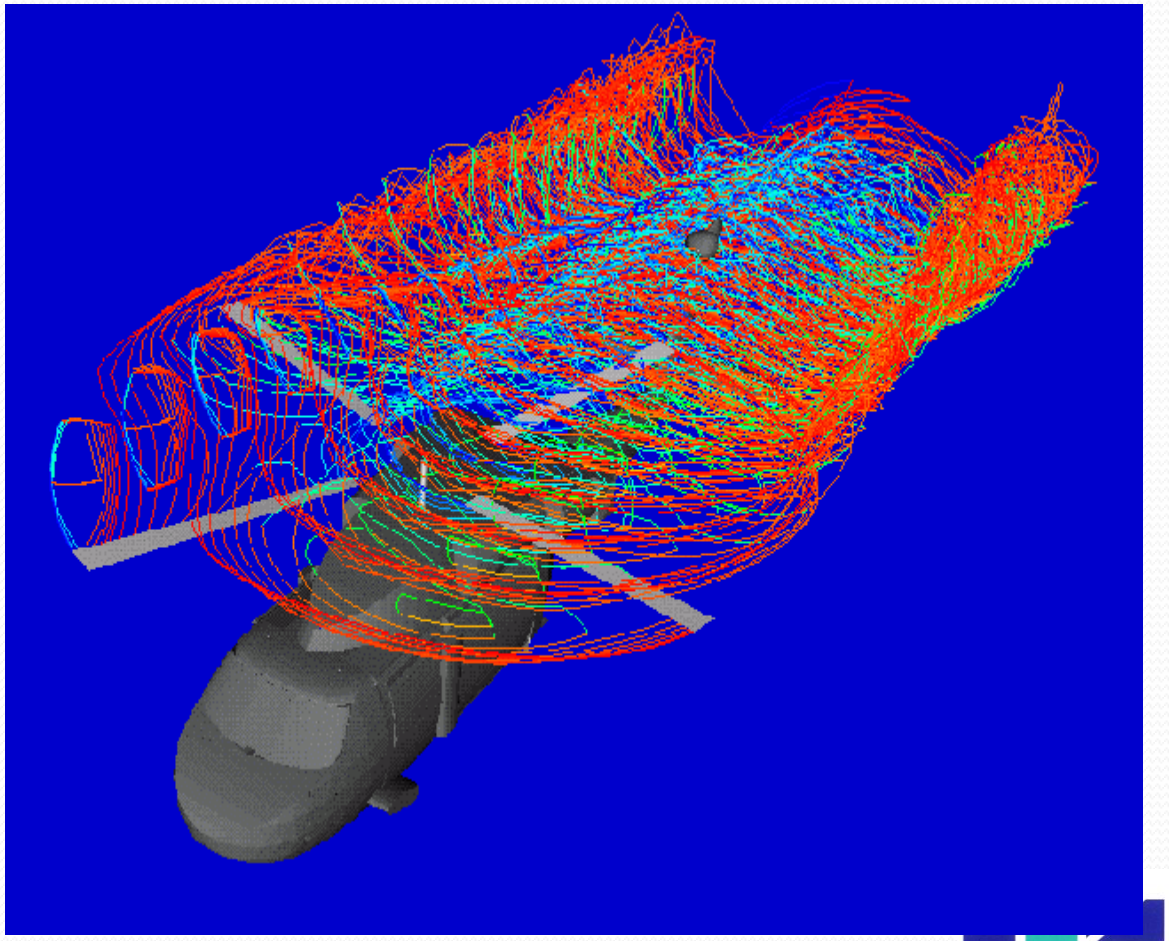
Helicopter Wakes



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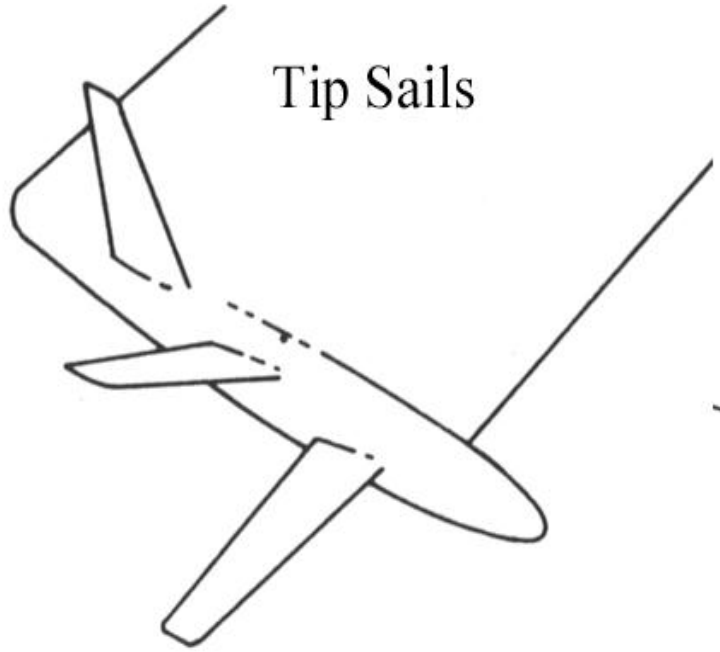
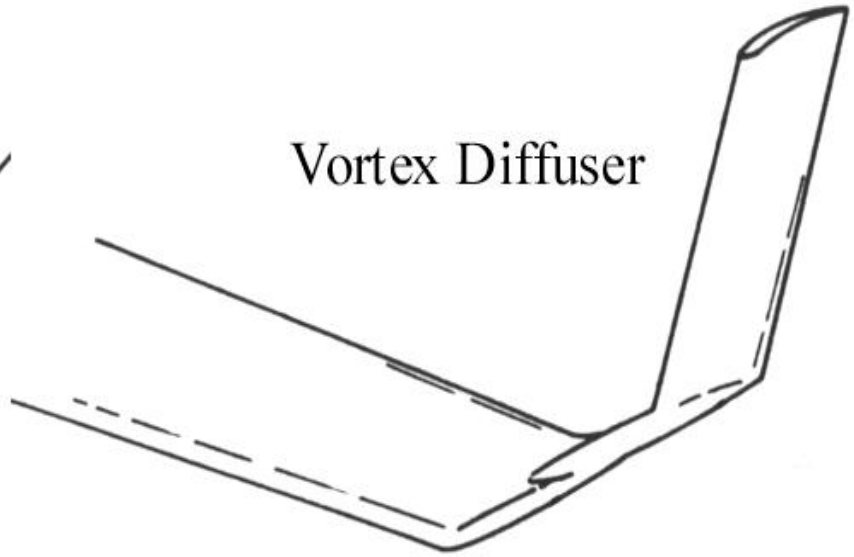
3. Wing Tip Modification Devices (John Spillman)

- Modeling suggests drift may be reduced by 50 - 75% using wing tip sails

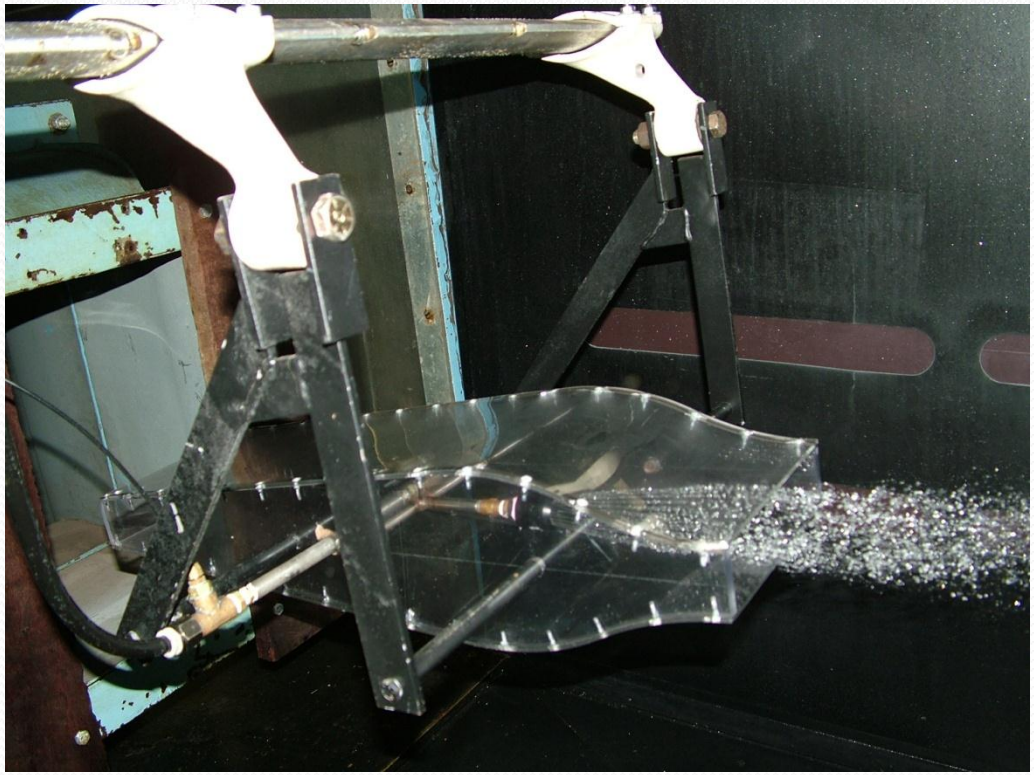




Reverse Venturi Chamber

(Russ Stocker)

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



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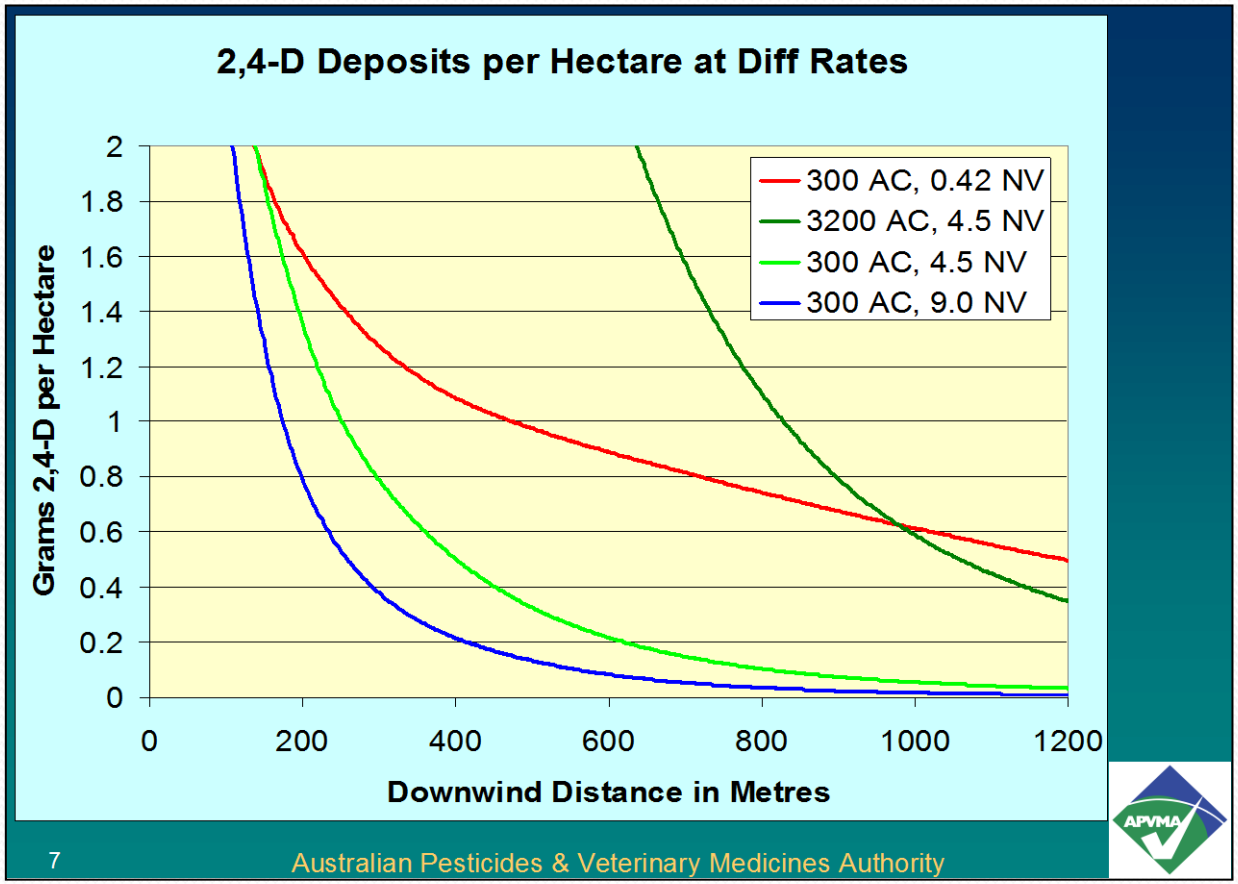
Other DRTs

- Non-volatile rate and evaporation reduction



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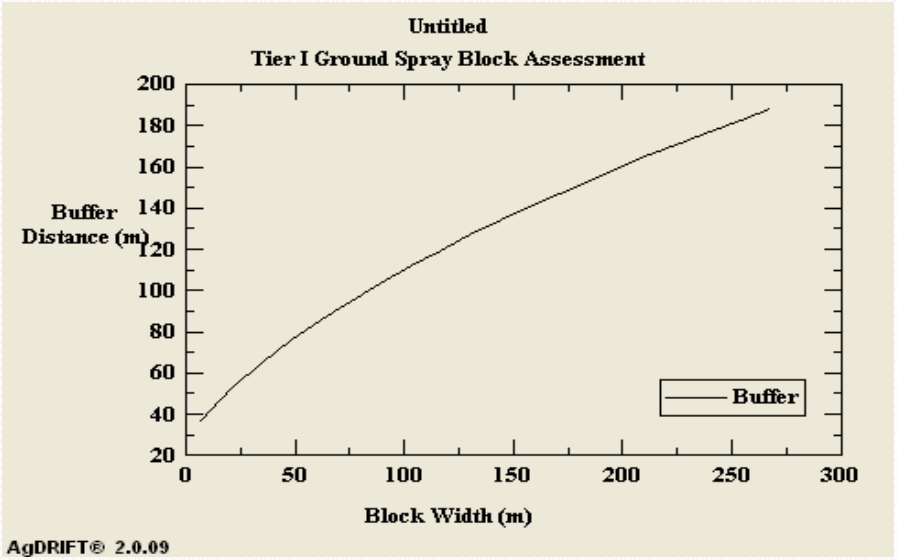
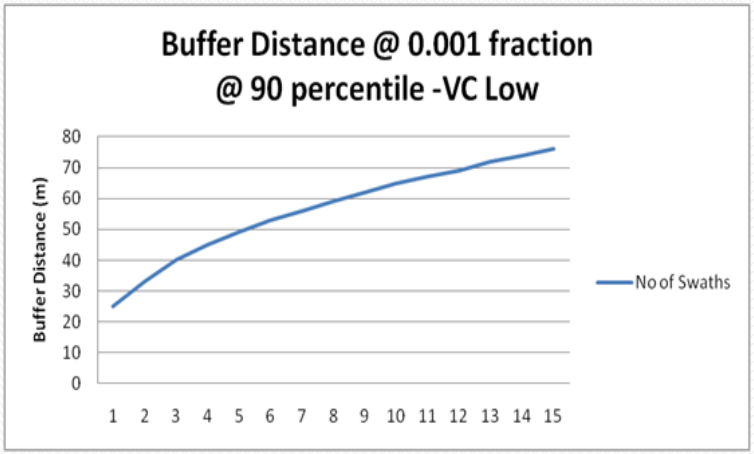
Spray Block Width

- 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%





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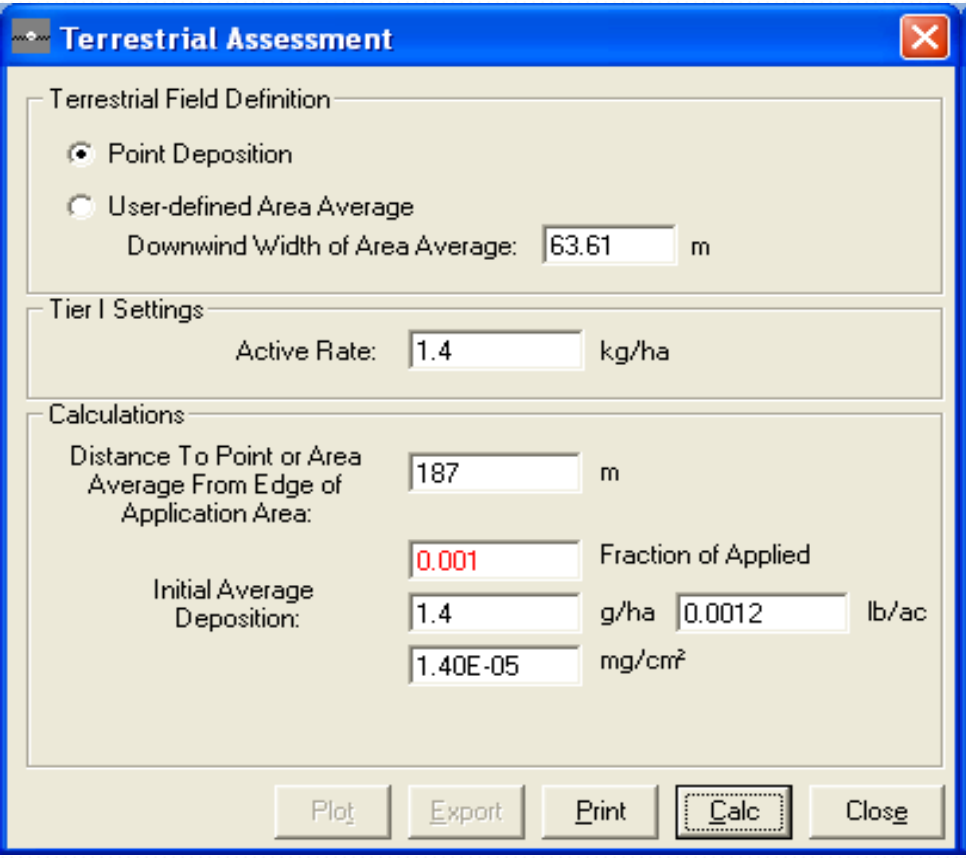
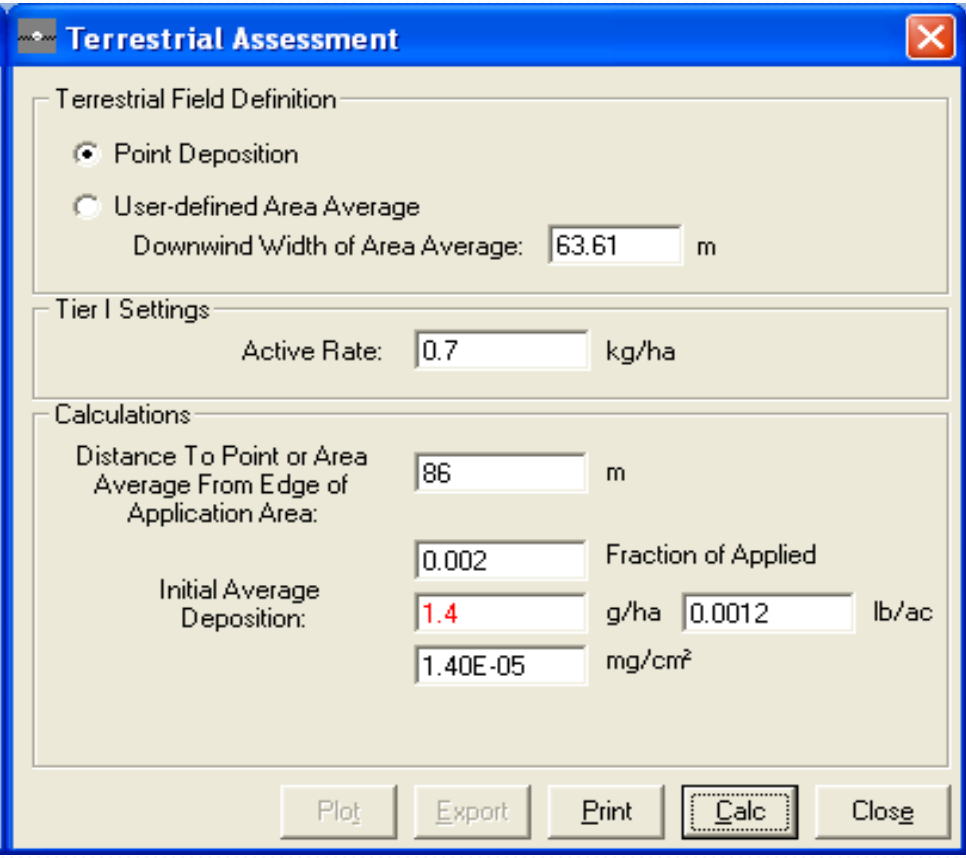
Example of 2,4-D Rate Reduction from 1.4 to 0.7kg/ha Giving Half the Buffer for LOC=1.4g/ha





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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

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