Executive Summary

The Australian Pesticides and Veterinary Medicines Authority (APVMA) implemented regulations on 1 March 2010 that require new pesticides to be assessed for the potential risk of spray drift. New label instructions can now contain statements that describe mandatory no-spray zones (buffer zones) in the downwind direction at the time of spray application. The labels of currently registered pesticides are also being reviewed to include comprehensive instructions for managing spray drift.

In October 2010, the National Working Party on Pesticide Application (NWPPA) engaged Plant Health Australia (PHA) (with funds provided by GRDC), to provide an independent report to the interim Executive Committee regarding the spray drift risk assessment of pesticides.

Specifically, PHA was commissioned to present a draft response plan to the NWPPA that provides an overview of the current status of the proposed spray application label changes by the APVMA, an analysis of the possible response options available to stakeholders across short and longer time frames, and a proposed model(s) for stakeholder participation and investment.

Following a period of consultation with a range of key stakeholders, and an analysis of relevant domestic and international research efforts, this report proposes that the NWPPA consider the implementation of nine projects.

These initiatives are designed to provide the APVMA with data, information and tools that will enable the Regulator to carry out the science-based assessment of drift reducing technologies (DRTs), and as a consequence facilitate access for growers and applicators to technologies that offset the need for the use of large downwind buffer distances.

In the short term (1-2 years), and as a matter of priority, it is proposed that a research project is undertaken in Australia to develop a comprehensive boom sprayer nozzle database and droplet size calculator that accommodates commercial formulations and adjuvants. Fortunately, the appropriate infrastructure exists in Australia to undertake this work. This database should be supported by the expansion and finalisation of an existing nozzle droplet size calculator for determining the performance of agricultural aircraft and the development of a series of wind tunnel reference deposition curves that can be used for the rapid evaluation and assessment of DRTs.

Building on current work being undertaken in Canada, it is also proposed that the current US AgDRIFT® model horizontal deposition curves, currently used by the APVMA, eventually be replaced with a new empirical model that describes the performance of modern nozzle systems and input values currently used by industry.
The horticulture and viticulture industries use a wide range of spray application technologies across a diversity of cropping systems and environments. It is proposed that these industries undertake a cross industry survey to document current practices and production risks (if any), associated with the implementation of mandatory downwind no-spray zones. This survey should be used to establish a national but limited field trial program that can establish industry best management spray practices and thus quantify the value of specifically identified DRTs.

In addition, but over a longer time frame, these initiatives should be supported by the development of a new national DRT training program that links label requirement with the training of applicators and accredited assessment of application equipment. This will ensure that the use of DRTs are implemented by well qualified practitioners and with accredited equipment that meets common national standards.

It is also proposed that work is undertaken to facilitate and maximise current international research efforts that seek to develop a fully predictable ground spray drift assessment model. A fully developed model, recognised and adopted by international agencies, would assist the assessment of DRTs in Australia and support the use of appropriate productive, efficacious and loss minimising application techniques by growers.

Fundamentally, a successful response to the issues described in this report will require the implementation of a nationally coordinated response involving multiple stakeholders. An opportunity exists for Australian regulators, industries and governments to work in partnership towards developing world class application systems and outcomes in Australia with benefits to productive capacity and the wider environment.
Introduction

In October 2010, Plant Health Australia (PHA) was commissioned by the Grains Research and Development Corporation (GRDC) to provide independent support to stakeholders (through the National Working Party on Pesticides Applications (NWPPA)) regarding the review of pesticide spray drift risk assessments being conducted by the Australian Pesticides and Veterinary Medicines Authority (APVMA).

Specifically PHA was asked to: (a) determine the information and model required to assist in the development of label application instructions to mitigate the need for default downwind buffer distances and (b) accommodate and recognise the appropriate use of drift reduction technologies (DRTs) by users.

During November 2010, PHA consulted with a wide range of stakeholders with an interest in spray drift risk assessment and the management of pesticides, including the APVMA, researchers, funding agencies, Australian spray technology manufacturers, consultants, applicators and state government agricultural departments (Table 1).

Background

The APVMA outlined processes for assessing risk from spray drift risk in a report (APVMA Operating Principles in Relation to Spray Drift Risk) which was finalised and released in July 2008. Effective March 2010, by means of an Operational Notice, the APVMA released “New Registration Application and Label Requirements in relation to Spray Drift Management”.

This was followed by “Supplement 1” released in November 2010 which defined changes to the definition of ‘orchards’ and droplet size criteria for orchard air blast spraying.

Newly registered products now contain new spray drift statements specifically defining application parameters pertaining to droplet size, meteorological conditions, the use of downwind mandatory buffer distances and record keeping requirements. This is illustrated in Figure 1 which shows example labels for the fungicide Amistar® (azoxystrobin) and the (newly registered) insecticide Movento® (spirotetam).

The example label demonstrates that highly specific downwind mandatory zones can now be incorporated into the label, making it a legal requirement for the operator to leave (under some circumstances) cropping areas unsprayed and untreated on the downwind side of paddocks where adjacent, prescribed, susceptible areas have been identified.
## Table 1. Stakeholder Consultation Program 2010

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Date</th>
<th>Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liaison and meetings with APVMA, Canberra</td>
<td>5/10/10, 1/11/10, 16/11/10, 10/1/11, 18/1/11</td>
<td>Subbu Putcha, Eva Bennet Jenkins, Les Davies</td>
</tr>
<tr>
<td>Meeting with HAL, Sydney</td>
<td>21/10/10, 25/1/11</td>
<td>Brad Wells, Peter Melville</td>
</tr>
<tr>
<td>Meeting with CRDC, Sydney</td>
<td>24/11/10</td>
<td>Tracey Leven</td>
</tr>
<tr>
<td>Meeting with Bayer, Melbourne</td>
<td>11/11/10</td>
<td>David Gregor</td>
</tr>
<tr>
<td>Meeting with Spraying Systems, Melbourne</td>
<td>11/11/10</td>
<td>Peter Alexander</td>
</tr>
<tr>
<td>Meeting with Silvan, Melbourne</td>
<td>12/11/10</td>
<td>Gavin Wheatcroft, David Rudolph</td>
</tr>
<tr>
<td>Meeting with University of Queensland/Lincoln Ventures, Queensland</td>
<td>29/10/10, 19/11/10, 23/1/11</td>
<td>Andrew Hewitt, Andrew Hewitt, Gary Dorr</td>
</tr>
<tr>
<td>Presentation to NWPPA</td>
<td>14/12/10</td>
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</tr>
<tr>
<td>Meeting with Hardi Pumps and Sprayers, Adelaide</td>
<td>26/11/10</td>
<td>Graeme Johnson, Corrie Eichner, Steve Parker</td>
</tr>
<tr>
<td>Meeting with Croplands, Adelaide</td>
<td>26/11/10</td>
<td>Jorg Kitt</td>
</tr>
<tr>
<td>Meeting with GWRDC, Adelaide</td>
<td>25/11/10</td>
<td>Troy Fischer</td>
</tr>
<tr>
<td>Meeting with Queensland University of Technology, Brisbane</td>
<td>18/11/10</td>
<td>Gary Dorr, Ian Turner</td>
</tr>
<tr>
<td>Meeting with Sugar RDC, Brisbane</td>
<td>17/11/10</td>
<td>Peter Twine</td>
</tr>
<tr>
<td>Meeting with Canegrowers, Brisbane</td>
<td>17/11/10</td>
<td>Matt Keeley, Bennie Milford</td>
</tr>
<tr>
<td>Meeting with Scion NZ and Plant Protection Chemistry NZ (PPCNZ), Rotorua</td>
<td>26-28/10/10</td>
<td>Brian Richardson, Alison Forster, Jerzy Zabkiewicz, Robyn Gaskin</td>
</tr>
<tr>
<td>Meeting with Elders Forestry, Melbourne</td>
<td>1/12/10</td>
<td>Marie Connett</td>
</tr>
<tr>
<td>Meeting with Aerial Agricultural Association of Australia, Canberra</td>
<td>2/12/10, 15/1/11</td>
<td>Phil Hurst</td>
</tr>
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<td>Meeting with Spray Smart Enterprises, Bendigo</td>
<td>30/11/10</td>
<td>Harry Combellack</td>
</tr>
<tr>
<td>Meeting with AUSVEG, Melbourne</td>
<td>10/11/10</td>
<td>Hugh Tobin, Andrew White</td>
</tr>
<tr>
<td>Meeting with Spray Safe and Save, Canberra</td>
<td>20/12/10</td>
<td>Craig Day</td>
</tr>
<tr>
<td>Presentation of Draft Interim Report for consideration by NWPPA</td>
<td>22/12/10, 3/2/11</td>
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<td>Meeting with Charles Sturt University, Wagga Wagga</td>
<td>7/1/11</td>
<td>John Kent</td>
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<tr>
<td>Communication with Grains Industry Training Network</td>
<td>20/12/10</td>
<td>Nickie Berrisford</td>
</tr>
<tr>
<td>Meeting with Dow Agrosciences, Sydney</td>
<td>24/1/11</td>
<td>Colin Sharpe</td>
</tr>
<tr>
<td><strong>States &amp; Territories</strong></td>
<td></td>
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<tr>
<td>Meeting with DEEDI, Brisbane</td>
<td>17/11/10</td>
<td>Geoff Cowles, Sandra Baxendell</td>
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<tr>
<td>Meeting with Victoria DPI, Victoria</td>
<td>9/11/10</td>
<td>Jonathan Fahey, Alan Roberts, Steven Field, George Downing</td>
</tr>
<tr>
<td>Meeting with PIRSA, South Australia</td>
<td>25/11/10</td>
<td>John Kassebaum</td>
</tr>
</tbody>
</table>
Figure 1. Spray Drift Instruction Comparison Amistar® and Movento®

CAUTION
KEEP OUT OF REACH OF CHILDREN
READ SAFETY DIRECTIONS BEFORE OPENING OR USING

Amistar® 250 SC
FUNGICIDE
Active Constituent: 250 g/L AZOXYSTROBIN
For the control of various diseases of grapes, potatoes, tomatoes, cucurbits, avocados, mangoes, passionfruit and poppies as per the Direction for Use.

GROUP K FUNGICIDE
APVMA Approval No: 58340/5/1005 Pack size: 5 L

WARNING
AMISTAR 250 SC is extremely phytotoxic to certain apple varieties.

AVOID SPRAY DRIFT. Extreme care must be used to prevent injury to apple trees.

DO NOT spray AMISTAR 250 SC where spray drift may reach apple trees.

DO NOT spray when conditions favour drift beyond the area intended for application. Conditions that may contribute to drift include thermal inversions, excessive wind speed, certain sprayer nozzle/pressure combinations, small spray droplet size etc.

DO NOT use spray equipment that has been previously used to apply AMISTAR 250 SC to spray apple trees. Even trace amounts can cause unacceptable phytotoxicity.

run-off) and matched to the crop being sprayed. Set up and operate the sprayer to achieve even coverage throughout the crop canopy using your chosen water volume. Determine an appropriate dilute spray volume (see Dilute spraying above) for the crop canopy. This is needed to calculate the concentrate mixing rate. The mixing rate for concentrate spraying can then be calculated in the following way:

Example only
1. Dilute spray volume as determined above: for example 1000 L/ha
2. Your chosen concentrate spray volume: for example 500 L/ha
3. The concentration factor in this example is: 2 x (1000 L - 500 L = 2)
4. If the dilute label rate is 80 mL/100 L, then the concentrate rate becomes 2 x 80, that is 160 mL/100 L of concentrate spray.

The chosen spray volume, amount of product per 100 L of

MANDATORY NO-SPRAY ZONES
DO NOT apply if there are livestock, pasture or any land that is producing feed for livestock downwind from the application area and within the mandatory no-spray zone shown in Table 1 below.

<table>
<thead>
<tr>
<th>Table 1: No-Spray Zones for Protection of International Trade</th>
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<tbody>
<tr>
<td>FOR AERIAL APPLICATION</td>
</tr>
<tr>
<td>Wind speed range at time of application</td>
</tr>
<tr>
<td>3 to 8 kilometres per hour</td>
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<tr>
<td>9 to 14 kilometres per hour</td>
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<tr>
<td>5 to 20 kilometres per hour</td>
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<tr>
<td>Downwind Mandatory No-Spray Zone</td>
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<tr>
<td>100 metres</td>
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<tr>
<td>120 metres</td>
</tr>
<tr>
<td>160 metres</td>
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<tr>
<td>FOR GROUND APPLICATION: BOOM APPLICATIONS</td>
</tr>
<tr>
<td>Wind speed range at time of application</td>
</tr>
<tr>
<td>3 to 20 kilometres per hour</td>
</tr>
<tr>
<td>Downwind Mandatory No-Spray Zone</td>
</tr>
<tr>
<td>10 metres</td>
</tr>
<tr>
<td>FOR GROUND APPLICATION: AIRBLAST APPLICATIONS</td>
</tr>
<tr>
<td>Wind speed range at time of application</td>
</tr>
<tr>
<td>3 to 20 kilometres per hour</td>
</tr>
<tr>
<td>Downwind Mandatory No-Spray Zone</td>
</tr>
<tr>
<td>80 metres</td>
</tr>
<tr>
<td>For citrus applications DO NOT apply if there are sensitive crops, gardens, landscaping vegetation, protected native vegetation or protected animal habitat within 20 metres downwind from the application area.</td>
</tr>
</tbody>
</table>
The provision of additional spray application technology requirements on labels has been perceived by most stakeholders as constructive and informative, but the use of significantly large mandatory downwind buffer areas (up to 300 m) has raised concerns regarding the viability of pesticide use in areas where geography, established boundaries and field size prevent the practical adoption of such drift mitigation techniques.

**Background: The Science**

The selective use of agricultural chemicals forms the backbone of most crop protection and plant biosecurity control programs in Australia. Often used as part of comprehensive integrated pest management programs, registered agricultural chemicals provide quick, reliable and safe methods for preventing or controlling pest attack, implementing pest eradication programs and maintaining domestic and international market access. However, as a technology, formulated commercial products are of little use unless they can be carefully and efficiently delivered to the biological target with minimum impact on the environment and non-target areas.

Most agricultural chemicals are applied as liquids so that relatively small amounts of active ingredient can be efficiently delivered and uniformly spread across large areas. The application of pesticides as sprays can be condensed into three primary phases:

- **Droplet generation** - a function of formulation and nozzle design
- **Droplet transmission** - movement through the air to the target, a function of formulation, droplet size and meteorology, and
- **Droplet capture** - recovery on target surfaces, a function of formulation, droplet size, velocity and surface structure

It is the understanding of the physics associated with these primary components that enable spray drift mitigation technologies and procedures to be introduced.

Figure 2 shows the deposition pattern resulting from multiple passes of an aircraft modelled using a Gaussian dispersion algorithm. In this analysis, simple spectrum monosized droplets have been applied, however the results clearly show that there is a distinct ground deposition pattern formed on the downwind (right hand side) of the applied area. The quantity of material deposited is dependent (with all other variables constant) to the emitted droplet size.

Other input variables have a strong influence on the resulting transmission and recovery of sprays and this is demonstrated in a simple sensitivity analysis of the deposition model. In this relative comparison of inputs to the model, the importance of initial droplet size is clearly illustrated (Figure 3).
Figure 2. Overlapped Ground Deposit - Gaussian Diffusion (monosized droplets). Application rate = 3 L/ha, wind speed = 3 m/s, release height = 3 m

Figure 3. Deposition 500 m Downwind of a Field (% of applied rate)
Background: APVMA Drift Reduction Technology Incentives (DRT) Program

The APVMA has recognised that the new spray drift management measures may prevent users from being able to use many agricultural chemicals because of farm size and proximity to sensitive areas. Therefore, in November 2010, the Regulator provided further information regarding its DRT program. Conceptually, this scheme allows for applicators who have access to verified technologies and procedures that reduce pesticide drift, to access smaller downwind buffer distances than those (default) values presented on product labels. The APVMA proposes that upon assessment and validation of appropriate data, a permit proposing a DRT can be issued. DRT permits that are product specific or attached to a particular technology will be available. The Regulator also proposes that the most up to date DRT permits will always be available on the APVMA website. Full details of the data assessment process have not yet been released.

Examples of different potentially acceptable DRTs are:

Nozzle technology - Consideration of an alternate nozzle design if it is proven to reduce drift compared with a standard nozzle.

Formulations and adjuvants - Consideration of an improved formulation (e.g. one that contains a wetter, surfactant) if it is proven to reduce drift compared to water only.

Equipment design - Consideration of different styles of application equipment if it is shown to reduce drift compared to traditional equipment.

Product dose rate - For products that have both very high and very low dose rates for different pests with the same application method, it may be possible to reduce the buffer zone if only the lower rate is used.

Background: Use of Spray Drift Models by APVMA

The assessment of the aerial application of pesticides by the APVMA is conducted using the latest versions of the US developed model AGDISP, a fully predictive model that attempts to describe the interaction of multiple input values, droplet behaviour and atmospheric physics (Figure 4). The development of AGDISP benefited from a US$25 million investment in the 1990s and considerable support by the United States Department of Agriculture (USDA) Forest Service. The model has been improved in recent years with the incorporation of GIS, GPS and biological efficacy sub-routines that have fine-tuned it particularly for forestry operations (Figure 4).

However, the model has recognised limitations. AgDRIFT®/AGDISP over-predicts Spray Drift Task Force (SDTF) field deposition values by 3-4 times at far-field distances (Bird et al. 2002). This phenomenon could result in the calculation of oversized buffer zone requirements in some circumstances. The causes of over-prediction are being investigated in current research programs. More specifically, work is being undertaken with AGDISP (Figure 5) to further improve:

- The effect of surface roughness on drift. Collection of field data on drift over canopy surfaces of different roughness (2012/13) (SCION)
- Droplet evaporation. Quantify effect of spray cloud on ambient humidity (2011/12)
- Droplet path length. Incorporate increased path length into AGDISP (USDA). Collect data on vortex penetration into plant canopies (2011/12), and
- Incorporation of droplet retention model in AGDISP (2009-2012)

However, unlike aerial application, spray drift deposition resulting from ground application is determined using a set of “reference curves” based on a regression analysis of data from field studies undertaken in the 1990s by the US SDTF. These curves incorporated into AgDRIFT do not enable the influence of a large number of input values to be varied and are more limited in their scope (Figure 6).

Figure 4. History of the Development of AgDRIFT and AGDISP
Figure 5. Mapping of Current and Proposed Research Programs
Background: Legislative Framework

At the 29th meeting of the Council of Australian Governments (COAG) held in Canberra on 19/20 April 2010, COAG agreed to a national policy framework for the assessment, registration and control of use of agricultural and veterinary chemicals. This framework outlines a policy that contains a number of principles relevant to the spray drift management of pesticides. It reinforces that the risks associated with chemical use should be managed based upon:

- A science-based risk analysis that is sound and current
- Risk assessment processes that are transparent, predictable and easily understood
- Processes that facilitate the operation of efficient activities in agriculture
- Processes that facilitate the broadest appropriate user access to chemical products
- Systems that encourage industry expertise and co-regulation
- Processes that provide incentives for users to develop and operate efficiently, and
- Systems that are robust and flexible enough to accommodate new technologies

Thus, under this proposed framework, industries have the opportunity to be involved in the co-regulation of a system where risk assessment is conducted on a rigorous scientific basis.

Background: Licensing and Training

A recent review of pesticide training and licensing requirements was conducted in 2010 by the Product Safety and Integrity Committee Working Group on Licensing and Training. The analysis showed that there is a significant variation in requirements across states, and as determined by cropping system, category of applicator (i.e. land owner, farmer), employee
of land owner, employees of organisations/companies and professional contractors (Figures 7a and b). This lack of a national approach is recognised as a significant background issue to the establishment of best spray management practices across industries.

Similarly, stakeholders have expressed that there is also lack of a national coordinated approach to applicator training. Although most jurisdictions support largely voluntary schemes for grower/applicator training (e.g. Chemcert/SMART train), and competency-based training programs are available in most states, stakeholders have reported that:

- There are a diversity of grower experiences and outcomes
- There has been a diverse quality and consistency of data and training provided to applicators
- There is a lack of a national content standard and tie back to peer reviewed (research) data, and
- There is a perceived lack of content management in programs provided by training organisations
### Figure 7a. Pesticide Training and Licensing Requirements 2010 – (e.g. Field Vegetables)

<table>
<thead>
<tr>
<th>Each page = separate chemical use situation</th>
<th>Columns = classes of user</th>
<th>Rows = each jurisdictions’ current position</th>
<th>Land Owner (ie Farmer)</th>
<th>Employee of land owner</th>
<th>Employees of organisations/Companies</th>
<th>Contractors who apply agvet chemicals for gain/reward</th>
<th>Aerial Sprayers (as a subset of contractors) Includes loaders and mixers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Queensland</strong></td>
<td><strong>Aerial – licensed for all pesticides (Ground – licence – herbicides only – licence therefore costed)</strong></td>
<td></td>
<td>NR</td>
<td>NR</td>
<td>NR (herbicidal only) AQF3 or exam</td>
<td>NR (herbicidal only) AQF3 or exam</td>
<td>L Business (AAC1L and Sprayer) L Plots (PCR1L and Sprayer)</td>
</tr>
<tr>
<td><strong>New South Wales</strong></td>
<td></td>
<td>Minimum AQF 2 AH0TC270BA Minimum AQF 2 AH0TC270BA Recommended AQF 3 AH0TC370BA Recommended AQF 3 AH0TC370BA</td>
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<td>L Business (AAC1L and Sprayer) L Plots (PCR1L and Sprayer)</td>
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<td><strong>Victoria</strong></td>
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<td>Minimum AQF 2 AH0TC270BA Minimum AQF 2 AH0TC270BA Recommended AQF 3 AH0TC370BA Recommended AQF 3 AH0TC370BA</td>
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<td>L Business (AAC1L and Sprayer) L Plots (PCR1L and Sprayer)</td>
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<tr>
<td><strong>South Australia</strong></td>
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<td>Minimum AQF 2 AH0TC270BA Minimum AQF 2 AH0TC270BA Recommended AQF 3 AH0TC370BA Recommended AQF 3 AH0TC370BA</td>
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<td><strong>Western Australia</strong></td>
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<td>Minimum AQF 2 AH0TC270BA Minimum AQF 2 AH0TC270BA Recommended AQF 3 AH0TC370BA Recommended AQF 3 AH0TC370BA</td>
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<td>L Business (AAC1L and Sprayer) L Plots (PCR1L and Sprayer)</td>
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<td><strong>ACT</strong></td>
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<td>Minimum AQF 2 AH0TC270BA Minimum AQF 2 AH0TC270BA Recommended AQF 3 AH0TC370BA Recommended AQF 3 AH0TC370BA</td>
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<td>L Business (AAC1L and Sprayer) L Plots (PCR1L and Sprayer)</td>
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<td><strong>Tasmania</strong></td>
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<td>Minimum AQF 2 AH0TC270BA Minimum AQF 2 AH0TC270BA Recommended AQF 3 AH0TC370BA Recommended AQF 3 AH0TC370BA</td>
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<td>L Business (AAC1L and Sprayer) L Plots (PCR1L and Sprayer)</td>
<td></td>
</tr>
</tbody>
</table>

**Key**

- **L** = Licence issued.
- **LE** = Licence with endorsements for specific use situations issued.
- **AQF** = Competency training (QAQF) required. Code is expanded to AQF2; AQF3; AQF4 as the case may be or PRPM.
- **TO** = Training (other) required (specified) – e.g. some jurisdictions may allow qualification for licence by passing an exam.
- **NR** = No requirements for the particular use situation by the particular class of user.
- **NA** = Not applicable.
- **X** = Exemption from certain legislative requirements for a class of user/situation or specific situation/chemical.
### Figure 7b. Pesticide Training and Licensing Requirements 2010 – (e.g. Broad Acre Cropping, Pasture Turf Production)

<table>
<thead>
<tr>
<th>Each page = separate chemical use situation</th>
<th>Land Owner (e.g. Farmer)</th>
<th>Employee of land owner</th>
<th>Employees of organisations’ Companies</th>
<th>Contractors who apply agvet chemicals for gain/reward</th>
<th>Aerial Sprayers (as a subset of contractors)</th>
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<tr>
<td>Columns = classes of user</td>
<td></td>
<td></td>
<td></td>
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<td>NR hand equip L (herbicides only) AQF3 or exam</td>
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<td>Minimum AQF 2</td>
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<td>NR or L – ACUP for S7 &amp; RUC &amp; RCP</td>
<td>NR or L – ACUP for S7 &amp; RUC &amp; RCP</td>
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<td>NR or AQF3 acc for S7</td>
<td>NR or AQF3 acc for S7</td>
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<td>NR Permit for 2,4-D use between 15 Sept to 15 April, risk assessment as part of application, no training requirement</td>
<td>NR Permit for 2,4-D use between 15 Sept to 15 April, risk assessment as part of application, no training requirement</td>
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<td>NR Permit for 2,4-D use between 15 Sept to 15 April, risk assessment as part of application, no training requirement</td>
<td>L – business Commercial Operator Licence L E - operator (cert of competency - cropping) RTC3704A RTC3705A</td>
<td>L Business (AAOL and Spraysafe) L Pilot (PCRL and Spraysafe)</td>
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<td>NR unless RCP</td>
<td>NR unless RCP</td>
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<td>PCRL AAOL TO Spraysafe</td>
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<td>NR or RTC 3704A</td>
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<td>RTC 3705A for S7 &amp; RCP</td>
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</table>

**Key**

- **L** = Licence issued.
- **LE** = Licence with endorsements for specific use situations issued.
- **AQF** = Competency training (QAQF) required. Code is expanded to AQF2; AQF3; AQF4 as the case may be or PRMPM.
- **TO** = Training (other) required (specified) – e.g. some jurisdictions may allow qualification for licence by passing an exam.
- **NR** = No requirements for the particular use situation by the particular class of user.
- **NA** = Not applicable.
- **X** = Exemption from certain legislative requirements for a class of user/situation or specific situation/chemical.
Current Overseas Approaches to Spray Drift Management

Regulators in Europe, the UK and the US have adopted a variety of approaches to mitigating the risk of downwind spray drift.

United Kingdom

Before pesticides are authorised for use in the UK, an environmental risk assessment that considers the potential for surface water contamination via spray drift is completed. Where the risk assessment identifies the potential for an unacceptably high predicted environmental concentration (PEC), a no-spray buffer zone may be used as a risk mitigation tool to ensure aquatic ecosystems are protected, otherwise the product is not authorised.

For some products farmers have the opportunity to reduce the no-spray buffer zone via the LERAP (Local Environmental Risk Assessment for Pesticides) scheme. The LERAP scheme provides arrangements for field crop (boom) sprayers and broadcast air-assisted (orchard) type sprayers. By using particular (LERAP accredited) equipment, applicators are able to adopt spray drift buffer zones of a few metres.

Germany

The German Federal Office of Consumer Protection and Food Safety (BVL) is responsible for authorising plant protection products for sale and use in Germany and ensure that they can be used without causing unreasonable adverse effects to humans, animals or the environment.

The risk caused by spray drift to humans is considered in the risk assessment by the Federal Institute for Risk Assessment, the risk to wild animals and other non-target organisms by the Federal Environment Agency (UBA). BVL considers spray drift in its risk management decisions by imposing spray drift mitigation requirements on the labels of plant protection products (for example the use of loss reducing equipment which has been tested and listed by the Federal Research Centre for Cultivated Plants – Julius Kühn-Institut (JKI)).

New Zealand

Environmental Risk Management Authority (ERMA) New Zealand considers exposure to spray drift when processing applications for the release of new pesticide formulations in New Zealand, and also through the reassessment of existing pesticides approvals. In order to manage risks from pesticides, ERMA New Zealand aims to control exposure to humans and the environment. Exposure is managed through a number of approaches, including placing controls/restrictions on certain pesticide application methods and rates, and at the point of sale. For example, many products can only be used by persons who are appropriately trained. Additionally, as a result of a recent reassessment of azinphos methyl, 50 m buffer zones to protect human health and the aquatic environment are required.

ERMA New Zealand’s exposure assessments are typically based on the use of data or models from overseas (e.g. the UK Chemicals Regulation Directorate model for bystander exposure and GENEEC2 aquatic exposure assessment model). ERMA New Zealand is working to improve exposure assessments and where possible will take New Zealand conditions into account. Additionally, ERMA New Zealand is looking to systematically include exposure to young children (as a vulnerable population) within the decision making process. Based on this improved exposure assessment, ERMA New Zealand aims to make improved decisions regarding the costs and benefits of pesticide use, and where appropriate add controls to
pesticides, such as buffer zones and specifications regarding spray droplet size, application techniques or technology.

United States of America

On 4 November 2009, the US Environmental Protection Agency (EPA) issued three documents for public comment which support the proposed guidance for pesticide spray drift labelling for pesticide products. These documents include:

- The proposed labelling guidance for pesticide applicants and registrants ("Pesticide Registration (PR) Notice 2009-X Draft: Pesticide Drift Labelling")
- A draft pesticide drift labelling interpretation ("Draft Pesticide Drift Labelling Interpretation"), and
- A document which provides EPA’s detailed discussion and rationale for the draft labelling and interpretation guidance, approach to spray drift management and specific questions for the public’s consideration ("Draft PR Notice 2009-X: Additional Information and Questions for Commenters")

The PR Notice indicates that as adopted in Australia ‘EPA is developing a DRT program, which will provide application equipment and spray adjuvant manufacturers with a test method and a process to voluntarily test and validate technologies for their drift reduction potential’.

Canada

Health Canada’s Pest Management Regulatory Agency (PRMA) has a mandate to ensure that pest control products do not pose unacceptable risks to human health or the environment. As such, the PMRA has developed policies and approaches to minimise off-site, non-target, exposures, including spray drift management. These include:

- Development of sustainable approaches to identify and protect sensitive habitats from non-target pesticide exposures, that take into account site specific conditions and encourage best management practices and environmental stewardship initiatives
- Specification of mitigation measures on product labels, including science-based buffer zones that reduce risks associated with pesticide spray drift
- Development of approaches that encourage applicators to use new technologies and sprayer configurations to reduce spray drift
- Provision of information to increase awareness of the effects of meteorological conditions on spray drift and encourage applicators to spray only under favourable conditions, and
- Development of simple and easy processes for applicators, including clear label instructions

Current Research Activities

There is currently some capacity and capability for undertaking immediate data collection and research in spray drift management in both New Zealand and Australia:

The Centre for Pesticide Application & Safety (CPAS) at the University of Queensland (Gatton Campus) maintains a wind tunnel research facility equipped with both low speed (wide dimension) and high speed (up to 140 knot) working sections. This facility has the capacity to conduct nozzle performance and boom sprayer assessment using commercial pesticide
formulations. The Centre also maintains a capacity to conduct a wide variety of spray drift measurements in the field

Queensland University of Technology (QUT) in conjunction with the University of Queensland and PPCNZ have recently secured a new three year Australian Research Council Linkage Grant to investigate, in partnership with private companies, the physics of droplet behaviour on plant surfaces. They wish to develop a suite of mathematical models to investigate spray drop interactions at the single leaf, whole plant and crop level, as well as develop software to visualise spray behaviour.

Plant Protection Chemistry New Zealand (PPCNZ Rotorua) have substantial experience in researching spray interaction, deposition and spray drift in New Zealand horticultural crops. They maintain a capability in field measurement of field applications (horticulture) and use of adjuvants.

SCION, a trading organisation for New Zealand Forest Research Institute Limited, is one of New Zealand’s Crown Research Institutes (CRIs). The primary responsibility of the organisation is to contribute to the achievement of national outcomes and the translation of research outcomes into benefits for New Zealand. Based in Rotorua, the organisation has undertaken substantial research in aerial application technology, particularly the development of models based upon AGDISP for modelling the interaction of sprays with forest canopies (Figure 4).

In conjunction with Lincoln Ventures Limited, a science and technology company owned by Lincoln University NZ, Scion and other stakeholders are currently engaged in a major six year project “Protecting NZ’s Environment from Pesticide Exposure”. This significant, and well funded, study is designed to generate:

- Reduced off-target agrochemical movements (drift & loss to the ground) by 2017 through new and improved technologies and tools for applicators
- Widely available models for spray decision-support and drift management, and
- In conjunction with CropLife America, the provision of new ground drift curves for North American conditions, a new proposed ground drift model and US buffer zone multiplier scheme based on such curves and Canadian/Australian/NZ approaches, and DRT validations in wind tunnel and field studies for use with a proposed US DRT scheme

The research includes field assessments as well as work supporting the development of new empirical and fully predictive models.

The field studies will be undertaken over six years with a focus on row, tree and vine crops. In the first 18 months, the following trials are planned:

- Grapes: October 2010 - January 2011 in Marlborough, NZ to monitor spray deposition in grape canopies using conventional and recycling sprayers and progression through all canopy growth stages
- Broadacre: June/July 2011 in Saskatoon, Canada with Dr Wolf, also tentatively in Australia/NZ in early 2011
- Kiwifruit: August 2011 in Bay of Plenty, NZ for hydrogen cyanamide application scenarios
- Trees: Early 2011 in Hawkes Bay, NZ to monitor spray deposition in apple canopies, aerial forestry work is planned for late 2011 near Rotorua, NZ, and
• Row crops: Early 2011, potential research into potato psyllid control.

A simplified overview of this current work, with overlayed projections for complimentary and effective new work, is mapped in Figure 5. The green arrows indicate potential investment opportunities, the yellow boxes indicate proposed new research areas to be supported.

Discussion

It is clear that the decision to implement mandatory buffer distances on pesticide labels is refocusing the attention of stakeholders on spray drift management and on product stewardship. There are many who believe that with inadequate preparation, there is potential for the implementation of large mandatory downwind buffers to remove significant areas of land from effective agricultural production.

Should mandatory downwind buffer zones be used? The concept is sound as demonstrated in this paper and the technique does provide default protection on the downwind side of sprayed areas. However, it is also recognised that the use of buffer zones as a drift limiting technique also has a number of limitations that need to be considered:

• Buffer zone distance may not always be accurate?
• Their use does not guarantee prevention of spray drift?
• Many paddocks could be considered “un-sprayable”, particularly in the absence of a planning system that allows for the establishment of an extended boundary or buffer zone between non-compatible land uses (e.g. agriculture and urban development)? Many paddocks are not square or rectangular. Where cropping areas are “V shaped” or are situated between multiple susceptible areas, growers may be faced with taking land out of production.
• They may not allow applicators to adjust spraying according to conditions?
• Their use may create unnecessary legal issues under ‘control of use’ legislation?
• Inappropriate use of the label may create opportunities for litigious complainants?
• Some applicators may be driven to select alternative products that do not contain explicit application instructions?

It is thus important that a response framework is established that enables industries and funding agencies to work in partnership with regulators to establish pragmatic but effective spray drift mitigation strategies.

Fundamentally, a successful response to the issues described in this report will require the implementation of a nationally coordinated response involving multiple stakeholders.

It is also clear that the adoption of DRTs by industries should be accompanied and supported by a new education and accreditation program for growers, so that the adoption of DRTs and implementation of stewardship programs can be demonstrated and audited. It appears that the current training system has not been fully successful. This may be because it has lacked a national focus and a definitive and uniform dynamic link back to university and peer reviewed research capable of facilitating and maintaining data standards. A higher standard of training accompanied by an accreditation system is desirable, if not essential.

The greater utilisation of existing regulatory tools, such as the use of the S7 system to cover high risk but less hazardous products, and the adoption of lower broad acre application speeds could also be supported by a new training and accreditation system.
It is proposed that a new national training and equipment accreditation program be established to support the introduction of DRTs across industries. A new training system should have the following features:

- A national focus and organisational framework
- Be supported by a consortium of tertiary institutions potentially organised through the Australian Council of Deans of Agriculture
- Be a prerequisite for applicators wishing to use DRT (low drift) options on new and revised pesticide labels
- Use a training syllabus developed by tertiary institutions supported by the provision of research data and independent experimental results on a national basis
- Allow for a train-the-trainers approach for delivery of the course in regional areas
- Include the independent testing and accreditation of applicator equipment as part of the DRT training program, and
- As a prerequisite require course participants to hold existing Registered Training Organisation (RTO) provided competencies in application technology

Although the increased regulation of the management of spray drift is causing significant issues for Australian agriculture the situation however, also provides significant opportunity for Australia plant industries, namely:

- Development of enhanced stewardship programs and greater adoption of best management practices
- Uptake and adoption of appropriate DRTs
- The setting of drivers for the development of new equipment that meets recognised specifications and delivers prescribed standards of application
- Facilitation of higher levels of efficacy for growers and lower off-target losses
- Facilitation of the development and fine tuning of key short and long term research methodologies, and
- The encouragement of constructive and effective communication and liaison with regulators

The need to provide further spray management information on labels may also provide opportunities for the APVMA to:

- Enhance, promote and fund transparent science-based assessment technologies and tools for its own use
- Foster relationships with registrants that allows the use of modelling tools to be utilised for growers to optimise application
- Facilitate the use of non-DRT technologies e.g. lower prescribed product application rates, where this lowers the potential for spray drift and improves application

**Responses**

Against this extensive and complex background, a range of responses are proposed across short (1-2 years), medium (2-3 years) and long (3-5 years) time frames (Table 3). The responses are designed to be complementary and comprehensive as well as practical and cost effective. Nine distinct initiatives are proposed. The project portfolio together with potential investment partners and project providers are also shown diagrammatically in Figure 8.
Figure 8. Project Portfolio – Investment Partners, Activities and Participants
In the short term (1-2 years), and as a matter of priority, it is proposed that a research project is undertaken in Australia to develop a comprehensive boom sprayer nozzle database and droplet size calculator that accommodates commercial formulations and adjuvants. Fortunately, the appropriate infrastructure exists in Australia to carry out this work. This database should be supported by the expansion and finalisation of an existing nozzle droplet size calculator for determining the performance of agricultural aircraft and the development of a series of wind tunnel reference deposition curves that can be used for the rapid evaluation and assessment of DRTs.

Building on current work being undertaken in Canada, it is also proposed that the current US AgDRIFT® model horizontal deposition curves currently used by the APVMA eventually be replaced with a new empirical model that describes the performance of modern nozzle systems and input values currently used by industry.

The horticulture and viticulture industries use a wide range of spray application technologies across a diversity of cropping systems and environments. It is proposed that these industries undertake a cross industry survey to document current practices and production risks (if any) associated with the implementation of mandatory downwind no-spray zones. This survey should be used to establish a national but limited field trial program that can establish industry best management spray practices and thus quantify the value of specifically identified DRTs.

In addition, but over a longer time frame, these initiatives should be supported by the development of a new national DRT training program that links label requirement with the training of applicators and accredited assessment of application equipment. This will ensure that the use of DRTs are implemented by well qualified practitioners and with accredited equipment that meets common national standards.

It is also proposed that work is undertaken to facilitate and maximise current international research efforts that seek to develop a fully predictable ground spray drift assessment model. A fully developed model, recognised and adopted by international agencies, would assist the assessment of DRTs in Australia and support the use of appropriate productive, efficacious and loss minimising application techniques by growers.

**Investment Strategies**

Possible investment partners and suggested contributions are set out in Table 2. Clearly, the funding of the projects will benefit from investment by multiple stakeholders and the consideration of the projects within a cohesive and national framework.

Special consideration needs to be given to investment by commercial life science companies. It is recognised that there is a legitimate requirement to protect data developed on new commercial registered pesticides. However, it is also important that the droplet spectra generated by a wide range of currently available commercial products is determined.
The need to protect data may be facilitated by:

(a) Spreading the cost (equally) across the 15 CropLife members and ensuring a wide selection of products can be included in the droplet spectra library provided to the APVMA?

(b) Ensuring the data and model(s) are only made available to the APVMA for the development of label instructions?

(c) Inviting other non-CropLife members to contribute to the initiative?

(d) Ensuring that model outputs are only made available to DRT accredited growers and applicators?

**Table 2 Project Portfolio – Proposed Investment Matrix**

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**Next Steps**

Following a review of the project portfolio and response plan outlined in this report, it is suggested that the NWPPA facilitate the development of an Implementation Plan. This plan should identify the participants and work required to facilitate the adoption of the response plan.

**References**


<table>
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<tr>
<th>Response</th>
<th>Rationale</th>
<th>APVMA Evaluation &amp; Acceptance</th>
<th>Potential Investment Partners</th>
<th>Activities &amp; Participants</th>
<th>Estimated Budget*</th>
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<td>1(a) Broadacre - Boom application nozzle database and calculator accommodating formulations and adjuvants</td>
<td>• Link to new Canadian study and back links to Australia and NZ study – back links to WTDisp • Can be developed as a standalone product • Basis for comprehensive national nozzle DRT database (developed to international standards) • Companion to AAAA approach, nozzle calculator • Establish benchmark curves for assessing competencies of DRTs • Opportunity to gain acceptance of “dual label” DRT permitted downwind reductions in buffer zones</td>
<td>• Outputs from calculator can be used to immediately and specifically position nozzle, formulation &amp; adjuvants on empirical ground deposit curves • The same information can be used in future drift assessment models</td>
<td>• Research &amp; Development Corporations • Chemical companies • Grower groups</td>
<td>• Opportunity to establish project with reduced per test costs • Opportunity to invite public and industry investment through the development of specific libraries</td>
<td>• $530k</td>
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<td>(b) Wind tunnel deposition curves (vertical &amp; horizontal) established for spray quality boundaries and prime DRT</td>
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<td>Potential Investment Partners</td>
<td>Activities &amp; Participants</td>
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<td>(Determines spray quality)</td>
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<td>• Chemical companies.</td>
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<td>• Industry association can assist/facilitate the management of data protection</td>
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</table>
| (3) Position Paper (Desktop). A detailed evaluation of current international responses and management of common technical issues | • Demonstrates relationship between international approaches and the current Australian regulatory position  
• Opportunity to determine world best practice and gain international understanding and response to common issues (e.g. data percentile values on regression curves)  
• Provides the rationale and justification for investment in project 9 | • Cross referencing with international regulators to enable Australian regulators to qualify and accept overseas and Australian data sets | • Research & Development Corporations                                                                                                             | • Desktop Study (requires consultation & some travel)  
• PHA  
• Consultants  
• DAFF                                                                 | • $80k |
| (4) Develop transparent understanding of APVMA model input values & risk assumptions | • Opportunity to develop realistic and practical DRT procedures by determining deposition limits and back modelling input variables  
• Response would assist both modelling and field-based assessment | • Data can be transparently assessed in risk assessment models with a minimum of conversion and data analysis | • Research & Development Corporations                                                                                                             | • Desktop Study requires consultation  
• PHA  
• Consultants  
• DAFF  
• State Governments  
• APVMA  
• Industry Associations e.g.  
• Cotton Australia, GPA, Ausveg                                                                 | • $50k |
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<tr>
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<th>Rationale</th>
<th>APVMA Evaluation &amp; Acceptance</th>
<th>Potential Investment Partners</th>
<th>Activities &amp; Participants</th>
<th>Estimated Budget*</th>
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| **(5) Horticulture – Industry Survey & Risk Analysis** | • An industry by industry analysis of industry/environment/equipment profiles  
• Development of a matrix to establish the high priority risk scenarios  
• Determine current best management spray practices across industries  
• Opportunity and necessity for, strong industry involvement | • Grower groups in partnership with HAL, GWRDC, SRDC, CRDC and RIRDC | • Industry Survey - requires consultation  
• PHA  
• Consultants  
• Survey should identify current practices, application best management procedures and characterise risk. Project would benefit from strong cross industry coordination through HAL | • $135k |

**Medium Term**

| (6) Development of a revised empirical model for boom sprayers | • More accurate and definite set of deposit curves capable of assessing broader range of input variables  
• Model more suited to assessing modern DRTs | • Model capable, upon verification, of replacing AgDRIFT® ground regression curves | • (Existing already funded – Canada, USA)  
• UQ and Canadian Researchers  
• PHA – facilitation to ensure outputs become available & meet APVMA requirements | • $50k (for facilitation) |
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| (7) Horticulture – Limited field testing of high risk spray scenarios using best management practices | Opportunity to:  
- Gain acceptance of “dual label” DRT permitted downwind reductions in buffer zones  
- Invite public and industry investment  
- Establish project with reduced per test costs  
- Develop an industry-based national program using a standard protocol. Scientific coordination, oversight and data analysis provided by specialist university researchers | Peer reviewed field data developed using national/international standards able to be evaluated by APVMA using current processes | Grower groups and chemical companies in partnership with RDCs  
- Links with current NZ research | National field trial program  
- HAL  
- GWRDC  
- SRDC  
- RIRDC  
- Industry groups  
- Universities (coordination and professional support) | $780k |
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| (8) Development of a new accredited training program for applicators seeking to implement DRT (short buffer) label instructions | • Opportunity to upskill growers and applicators with use of DRT technology  
• Ability to demonstrate in field use of BMP and DRT procedures by industries  
• Provides mechanism to link training on a national basis  
• Provide a mechanism to link common teaching framework to university research  
• Provides a pathway for linking new DRT research to growers and regulators  
• Provide mechanism to perform basic tests on current spray equipment | • Demonstrates to APVMA skill level, uptake and adoption of DRTs by growers and applicators  
• Training program formally tied to use of DRT technology on labels | • Industry and growers  
• Research & Development Corporations  
• Jurisdictions | • Tertiary and vocational institutions  
• Australian Council of Deans of Agriculture  
• State ag departments  
• Consultants/RTOs  
• RDCs  
• Growers & applicators  
• Initial funding required for consultation and establishment of DRT training program  
• Program maintained by participant subscription  
• Peak industry bodies | • $500k (start-up)  
• Self funding |
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<td><strong>Long Term</strong></td>
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<td>(9) Provision of support for the development of an international, fully predictive ground model</td>
<td>• Coordination &amp; facilitation of the international research program (e.g. Quads (Canada, NZ, USA &amp; Australia))&lt;br&gt;• Opportunity to contribute by providing internationally recognised DRT data libraries&lt;br&gt;• Opportunity to build upon and encourage current international efforts&lt;br&gt;• Could lead to the international acceptance of an agreed drift assessment procedure</td>
<td>• Ready acceptance of international, fully coordinated and developed predictive models</td>
<td>• Research &amp; Development Corporations&lt;br&gt;• Chemical companies subject to appropriate data protection in place</td>
<td>• PHA&lt;br&gt;• DAFF</td>
<td>• $250k</td>
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*Budget estimate only. Detailed budget to be calculated on establishment of project protocols. See Table 2.*