If you are participating in the presentations this year, please provide a written report and a copy of your final report presentation by 31 October. If not, please provide a written report by 30 September.

Part 1 - Summary Details

Please use your TAB key to complete Parts 1 & 2.

CRDC Project Number: **BGC1001**

Project Title: **B**uilding industry capacity for continual improvement of application & drift management

Project Commencement Date: 1/7/2009 **Project Completion Date:** 30/6/2012

CRDC Program: Human Capacity

Part 2 – Contact Details

Administrator: Bill Gordon (director)
Organisation: Bill Gordon Consulting Pty Ltd
Postal Address: PO Box 4197 Lawrence NSW 2460
Ph: 0266477564 **Fax:** **E-mail:** bill.gordon@bigond.com

Principal Researcher: Bill Gordon
Organisation: Bill Gordon Consulting Pty Ltd
Postal Address: PO Box 4197 Lawrence NSW 2460
Ph: 0266477564 **Fax:** **E-mail:** bill.gordon@bigond.com

Supervisor: Bill Gordon
Organisation: Bill Gordon Consulting Pty Ltd
Postal Address: PO Box 4197 Lawrence NSW 2460
Ph: 0266477564 **Fax:** **E-mail:** bill.gordon@bigond.com

Signature of Research Provider Representative: _____

Part 3 – Final Report Guide

Background

1. Outline the background to the project.

In the seasons leading up to this project, the cotton industry has experienced significant losses due to damage from spray drift events. Cotton Australia estimated that at Jan 22, 2009 more than 9.3% of the 2008/2009 cotton crop had been affected by Phenoxy damage, with a farm gate value of $8.4million dollars and rising. This was greater than the 2007/8 estimated area of damage at 6% of the total crop valued at $5.08million. The increase in damage due to spray drift has largely coincided with the increased capacity of ground sprayers and the use of GPS, allowing greater areas to be sprayed at night. Typically this damage occurred following rainfall events and summer fallow spraying in predominantly min-till cropping areas surrounding cotton growers.

The aim of this project was to help protect the viability of cotton growers in areas that have received large scale drift events, and to raise awareness of the spray drift issue, and factors that minimise the risk of such events happening.

Objectives

2. List the project objectives and the extent to which these have been achieved.

Objective 1

1.1 & 1.2 *Conduct at least one large scale drift study by 15/12/2009*

The drift study was completed at Millee in 2011. Preliminary results were provided to CRDC and GRDC for consideration. It was determined by both organisations that the results should be passed on to the National Working Group on Pesticide Application for further consideration, and possible replication before the results are published.

This objective was completed, and the results are discussed in the results section of this report.

Objective 2

Complete at least 48 co-funded application and drift management workshops

2.1 18 x AWM workshops 2009/2010 delivered and evaluated
2.2 16 x AWM workshops 2010/2011 delivered and evaluated
2.3 14 x AWM workshops 2011/2012 delivered and evaluated

These milestones were fully completed and exceeded, the outputs are discussed further in the results section of this report.

Objective 3

3.1 Update application section of pest management manual 2009

The application section was updated by Bill Gordon, who also updated the application section of the new myBMP module (and the grains BMP module, to ensure a high level of integration between the two)

3.2 Update weather and application sections of industry publications 2010 -
.

The weather section was updated in the pest management guide and in the cotton production manual.

BGC commissioned the first draft of the 'general meteorology for pesticide application' manual produced by Graeme Tepper at all application and drift management workshops delivered in this project.

The meteorology section of the workshop has also been updated, resources such as power point presentations have been provided to trainers.

3.3 Update industry publications

Bill Gordon has made contributions to: The Cotton Production Manual, The Cotton Pest Management Guide, The myBMP Pesticide Module and CottonMap (input and feedback)

BGC also updated chapters in Chemcert NSW, Auschem Qld and Auschem Victoria Chemcial User Accreditation Training Manuals

This is discussed further in the results section of this report.

Objective 4

4.1 A total of 3 demonstration trials by 30/1/2011

3 trials with the Weedseeker have been completed, with articles released on Weedseeker nozzle selection, calibration and mixing requirements. Results were also presented at 6 precision agriculture workshops for growers and advisors.

2 efficacy based drift management trials with over the top roundup ready herbicide were completed by Agrisearch (details of trials are included in appendix 4).

4.2 A total of 6 demonstration trials by 30/1/2012

A further 2 efficacy based trials were completed in late summer (2011/12), bringing the total number of trials completed to 7 (1 more than the project milestones).

A summary of the trial results are discussed in the results section of this report, with trial details included in appendix 4.

Objective 5

5.1 Complete a total of 2 train the trainer workshops by 30/6 2010

Presentations were given at the annual trainer PD workshops for Auschem Qld and Chemcert NSW.

2 additional train the trainer workshops were run in NSW in conjunction with the GRDC project.

5.2 Complete a total of 4 train the trainer workshops by 30/6/2011

Presentations were given at the annual trainer PD workshops for Aushcem Qld and Chemcert NSW

5.3 Complete a total of 6 train the trainer workshops by 30/6/2012

Presentations were given at the annual trainer PD workshops for Aushcem Qld and Chemcert NSW.

A total of 10 trainers also attended workshops delivered to cotton growers as a part of their on-going professional development requirements.

The details of these workshops are discussed further in the results section of this report.

Objective 6: Attend and give presentations at 3 industry functions per year

This objective was completed (and exceeded)

6.1 Attend and give presentations at 3 industry functions per year 2009/10

Bill Gordon has given presentations at more than 3 industry functions including Glycom, GRDC updates (Dalby and Narrabri).

6.2 Attend and give presentations at 3 industry functions per year 2010/11

Bill Gordon presented a seminar at the 2011 cotton trade show, and provided information on banded spraying at a trade show booth. The NSW Ground Sprayers Association annual workshop, and at 6 presentations at the Precision Spray Application Workshops regarding changes to the Weedseeker® setup.

6.3 Attend and give presentations at 3 industry functions per year 2011/12

Bill Gordon presented at the 2012 CCA Cropping Solutions Seminar at Moree, Presented at the Australian Ground Sprayers Association annual conference

(Adelaide), The Landmark Annual Farm Service Conference for advisors, at two GRDC advisor updates in NSW, and presented at a national adjuvants conference in WA.

- BGC also presented updates to cotton growers and advisors at 2 breakfast meetings in the lower Namoi and Border Rivers.

Objective 7

7.1 Participate in up to 6 meetings with industry and regulators per year: 2009/2010

This objective was completed, some highlights include:

- Bill Gordon contributed to the PSIC working group on training and accreditation (for the productivity commission) for the Chemicals and Plastics review.
- Bill Gordon presented a workshop at the NSW Ground sprayers annual workshop.
- Bill Gordon attended a national application workshop at Atwood, Victoria
- Bill Gordon has attended 3 meetings with various Chemcert organisations, negotiating the national roll out of the application and drift management workshops as a re-accreditation option.

7.2 Participate in up to 6 meetings with industry and regulators per year:2010/2011

This object was completed, some examples include:

- Bill Gordon attended 2 x National Working Party on Pesticide Application (NWPPA) meetings in relation to No Spray Zones and APVMA spray drift risk assessment legislation at Canberra.
- Bill Gordon has attended 4 meetings with various Chemcert organisations, negotiating the national roll out of the application and drift management workshops as a re-accreditation option.
- Bill Gordon presented at a national Adjuvants workshop in Perth, WA.

7.3 Participate in up to 6 meetings with industry and regulators per year: 2011/2012

- Bill Gordon attended and presented at a meeting in Sydney on the skills sets required by applicators,
- Attended NWPPA meetings in Canberra, 2012,
- Bill Gordon participated in meetings with John Kent on the review of Pesticide Application Training in Australia,
- Bill Gordon held 6 meetings with training providers regarding current and future courses.
- Bill Gordon Presented at the National Ground Sprayers Association conference (Adelaide).

Further examples are included in the results section of this report

Objective 8

8.0 Steering committee established and meets on a regular basis.

This objective was completed.

The steering committee was formed, and met annually (three times during the project).

Reports on activities and evaluation summaries were provided to the committee members.

The role of the steering committee and outcomes are discussed further in the results section of this report.

Methods

3. Detail the methodology and justify the methodology used. Include any discoveries in methods that may benefit other related research.

Many outputs from this project were delivered as a result of collaboration with, and co-funding from, the GRDC funded project "raising awareness of drift reduction techniques"

Year 1 activities included:

- Delivery of one large scale drift study (co-funded by GRDC) conducted at Millee, NSW. This study attempted to evaluate and quantify the potential movement of products associated with spraying operations at night on flood plains in the cotton growing valleys, during the summer months using the resources of CPAS, BGC, CCA members and cooperative growers and applicators.

  This study utilised a range of cations as 'tracers' in place of the fluorometric techniques traditionally used by CPAS. The use of mass spectrometry to detect the levels of deposition of the cations on a range of targets provided an excellent level of sensitivity and was a relatively inexpensive to analyse samples.

  Results of this study as discussed in the results section of this report, and were provided to CRDC and GRDC for consideration and were referred to the National Working Party on Pesticide Application (NWPPA).

- More than 18 Application and Drift Management Workshops (co-funded by GRDC) were delivered to growers on drift reduction techniques and efficacy (intense coverage of areas of concern)

- BGC provided technical advice and representation to Cotton Australia, APVMA and to industry forums.

- BGC delivered 2 train the trainer workshops focusing on aspects of cotton productions for providers chemical user training and industry extension personnel.

Year 2 activities:

- BGC Conducted and reported outcomes of 5 demonstrations trials evaluating efficacy and drift reduction for AWM groups, and reported findings at industry functions. Three trials involved evaluating Weedseeker® setups, nozzle selection and deposition.

  These trials were conducted at 3 locations on the Liverpool plains during the period between July and November 2009. Deposition on WSP was collected under field conditions when 1, 2 or 3 sensors fired to determine the actual sprayed width and applied rate in the field of the Weedseeker by using image analysis equipment. The results of these trials are included in an article included in appendix 5 of this report.

Two replicated efficacy trials evaluating drift reduction setups for Roundup Ready applications in solid plant situations were conducted by Agrisearch (trial reports and results included in appendix 4).

- More than 16 Application and Drift Management workshops (co-funded by GRDC) were delivered to growers and applicators on drift reduction techniques and efficacy. Evaluation data are included in appendix 2b and summarised in the results section of this report.

- BGC provided technical advice and representation to Cotton Australia, APVMA and to industry forums.

- 2 train the trainer workshops focusing on aspects of cotton production were delivered to providers chemical user training and industry extension personnel.

Year 3 activities:

- 2 replicated efficacy trials related to Roundup Ready applications in wide row cotton were conducted by Agrisearch, with results reported at industry forums, such as the CCA annual meeting. Experimental details and results are included in appendix 4.

- BGC updated the application technology sections of the resource materials of industry publications such as the Cotton Production Manual and Pest Management Guide and the application component of the myBMP pesticide module.

- More than 14 Application and Drift workshops (co-funded by GRDC) were delivered to growers on drift reduction techniques and efficacy. Details of workshops and a summary of the evaluation are included in the results section of this report, with raw data included in the appendices.

- BGC provided technical input and representation to Cotton Australia, APVMA and at industry forums.

- BGC Delivered 2 train the trainer workshops focusing on aspects of cotton production for providers chemical user training and industry extension personnel. Bill Gordon also reviewed chemical user accreditation courses in Qld and NSW to plan for future training programs.

Details of workshop locations, participant numbers and evaluation summaries are included in the results section of this report

Results

Objective 1: Conduct one large scale drift study

This study involved contracting the services of the Centre for Pesticide Application and Safety from the University of Queensland.

There were some delays in getting CPAS to conduct the study, and some issues with the protocols and equipment used, however the trial did yield some interesting results.

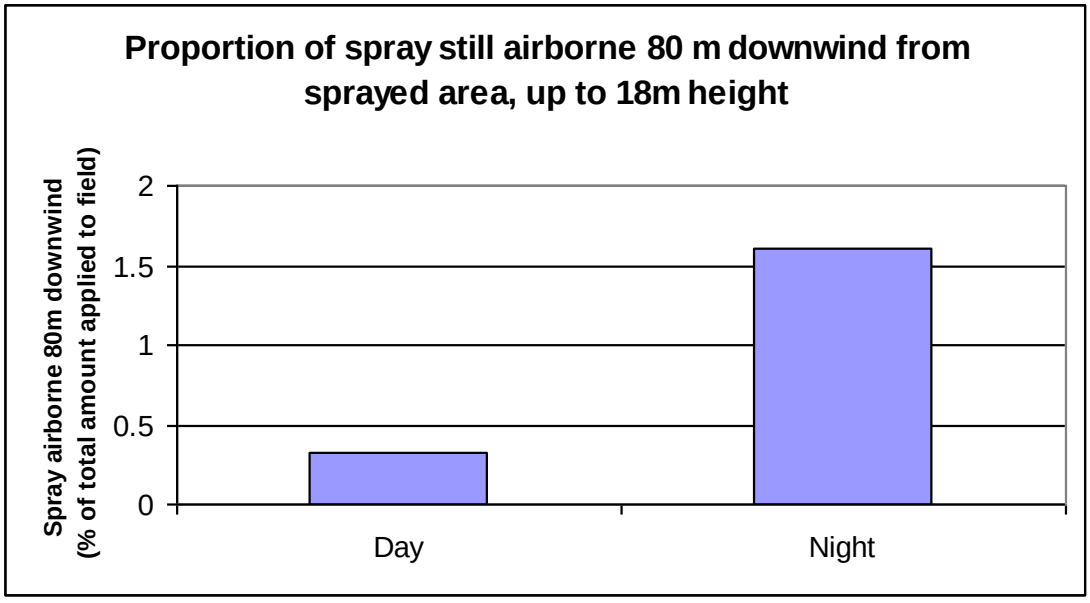
The drift study conducted at Millee, NSW in the summer of 2011 comparing the drift potential from daytime spraying (approximately 7.00am) and night time spraying (approximately 2.30am) using a 36m trailing sprayer to spray an area of approximately 50 ha, operated at 22 km/h with nozzles rated to produce a coarse spray quality.

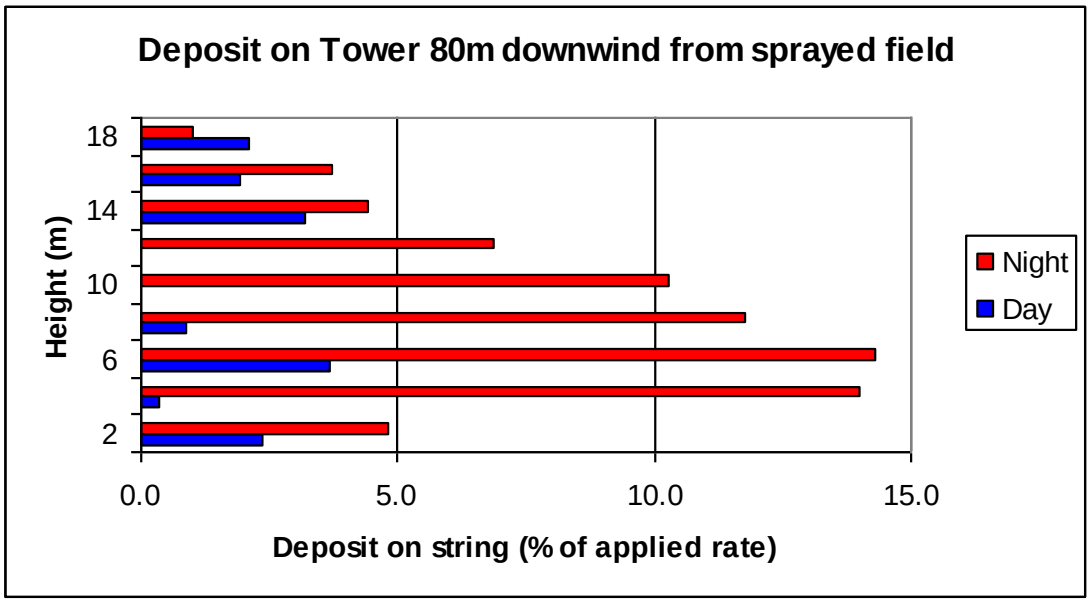
The average conditions during the trial were as follows:

	Wind Speed (km/ hr)	Wind Direction (°)	Temperature (°C)	Relative Humidity (%)	Stability Ratio
Night	11.6	19	25.5	64	0.26
Day	18.3	4	28.7	61	-0.29

The results of this study indicated that the night spraying operations greatly increased the amount of product likely to remain airborne.

The following graphs illustrate that night spraying increased the airborne fraction more than 5 times that resulting from an equivalent daytime application, as measured on a 20 m tower located 80m downwind from the release point of the spray.





This single trial highlighted the increased risk associated with night time spraying.

The results of this study were not published at the request of CRDC and GRDC, however they were provided to the National Working Party for Pesticide Application for further consideration.

Objective 2: Complete at least 48 co-funded application and drift management workshops.

A total of 53 workshops (48 co-funded by GRDC) were delivered to 1046 cotton and grain growers throughout the cotton growing region.

An additional 6 workshops were provided to 103 advisors working in cotton growing regions, over and above those workshops contracted to be delivered to growers.

The following table summarises workshops delivered for grower and advisors during the 2009-2012 project.

Date	Event Name	Event Type	Target Audience	Location	Venue	Participants
30/07/2009	Consultants' W'shop on Application Technology and Drift Management	W'shop	Advisor	Narrabri	ACRI	13
19/08/2009	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Goondiwindi	TCC, Goondiwindi	27
25/08/2009	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Wee Waa	Willawah	13
26/08/2009	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Maules Creek	Warrilea	13

27/08/2009	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Narrabri	Auscott Midkin	14
31/08/2009	UNE Grains Production Course Application W'shop	W'shop	Advisor	Tamworth	DPI training room	21
1/09/2009	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Wee Waa	Waverley	17
2/09/2009	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Wee Waa	Hazledean	17
3/09/2009	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Wee Waa	Gundera	15
9/09/2009	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Spring Plains, Wee Waa	Warriana	17
14/09/2009	Application Technology and Loss Management W'shop	W'shop	Grower	Jimbour, Qld	Jimbour Hall	12
16/09/2009	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Merah North, via Wee Waa	Lammermoor	19
17/09/2009	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Burren Junction	Riverview	17
10/11/2009	Detailed Sprayrig Checkup with ASKGB	W'shop	Grower	Wee Waa	Willawah	6
10/11/2009	Detailed Sprayrig Checkup with ASKGB	W'shop	Grower	Wee Waa	Gunedra	6
11/11/2009	Detailed Sprayrig Checkup with ASKGB	W'shop	Grower	Hazeldeen	Merah North	6
11/11/2009	Detailed Sprayrig Checkup with ASKGB	W'shop	Grower	Burren Junction	Waverley	6
12/11/2009	Detailed Sprayrig Checkup with ASKGB	W'shop	Grower	Spring Plains	Warrianna	6
12/11/2009	Detailed Sprayrig Checkup with ASKGB	W'shop	Grower	Maules Creek	Warrilea	6
24/11/2009	Drift Management W'shop	W'shop	Grower	Pampass, Qld	"Laguna"	10
3/12/2009	Pre-Summer Drift Awareness Breakfast Meetings	W'shop	Grower	Moree	Moree Tafe	30
3/12/2009	CFI Spray Night	W'shop	Grower	Moree	Muldoon	57
4/12/2009	Pre-Summer Drift Awareness Breakfast Meetings	W'shop	Grower	Rowena	Community Hall	27
21/07/2010	UNE Cotton Production Course Application W'shop	W'shop	Advisor	Narrabri	ACRI	6
23/08/2010	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Breeza	'Drayton'	16
24/08/2010	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Boggabri	Kilmarnock W'shop	23
14/09/2010	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Jimbour	'Kielli'	28
6/10/2010	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Goondiwindi	Goondiwindi TCC	8
14/12/2010	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Yagaburne	Yagaburne Club	20
15/12/2010	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Lundavra	Lundavra Club	8

31/01/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	North Star	North Star Sporting Club	14
1/02/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Goondiwindi	Goondiwindi RSL	15
2/02/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Westmar	Westmar Sporting Club	12
17/03/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Theodore	'Paranui'	42
18/03/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Jambin	'Lorraine'	27
21/03/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Clermont	'Undarra Downs'	56
22/03/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Capella	'Kurrajong'	45
23/03/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Gindie	Denlo Park'	49
25/05/2011	Australian Cotton Trade Show Seminar	Ind. Meet	Grower	Moree	Moree Tafe	35
29/08/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Goondiwindi	RSL Club	35
30/08/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Norwin	CWA Hall	17
7/09/2011	UNE Cotton Production Course Application W'shop	W'shop	Advisor	Narrabri	ACRI	22
13/09/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	St George	DEEDI	12
22/06/2009	Chemical User Training Providers Meeting	Ind. Meet	Others	Adelaide	PIRSA Building	15
6/07/2010	PSIC Training and Licensing Group Members	Ind. Meet	Others	Adelaide	Chiefley on South Terrece	15
8/07/2010	Chemical User Training Providers Meeting	Ind. Meet	Trainers	Adelaide	Chiefley on South Terrece	15
27/07/2010	Spray Drift Steering Committee	Ind. Meet	Advisor	Mascot	Cotton Australia	11
29/08/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Goondiwindi	RSL Club	35
30/08/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Norwin	CWA Hall	17
7/09/2011	UNE Cotton Production Course Application W'shop	W'shop	Advisor	Narrabri	ACRI	20
13/09/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	St George	DEEDI	12
11/10/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Yenda	Michael Pfitzners Farm	16
13/10/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Comobella	Comobella Hall	15
14/10/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Coonamble	Wingadee'	9
2/11/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Griffith	DPI training room	8

3/11/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Coleambally	Community Hall	11
16/12/2011	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Warialda	Gunnywirildi'	9
17/01/2011	Half Day AWM Application Technology and Loss Management W'shop	W'shop	Grower	Condamine	Anglican Church Hall	28
19/01/2012	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Rowena	CWA Hall	21
25/01/2012	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Yelarbon	Oasis Hotel	18
15/02/2012	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Griffith	Gemini Hotel	15
7/03/2012	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Cecil Plains	Wamara	39
8/03/2012	AWM Application Technology and Loss Management W'shop	W'shop	Grower	Jimbour	Kieli	25
17/04/2012	NWPPA meeting	Ind. Meet		Canberra	Federal Golf Club	
2/05/2012	Auschem Qld PD Training Workshop	Ind. Meet	Trainers	Brisbane	Riverside Hotel	23
16/05/2012	CCA Cropping Solutions Seminar	Ind. Meet	Advisor	Moree	The Max Hotel	133

**Please note that not all industry meetings and events attended as a part of this project are included in the above table, due to a change in the data base used to record data during the project. A more complete list of events and outputs is included in the appendices to this report.*

Evaluation of workshops

An independent evaluation of workshop participants by an external consultant in July of 2010 showed that more than 80% of the participants surveyed had changed one or more practices within 3-6 months of attending the workshops delivered prior to that date. A copy of the report compiled by MaurRouche Agriculture in July 2010, was provided to CRDC (an additional copy of this report has been included in the appendices).

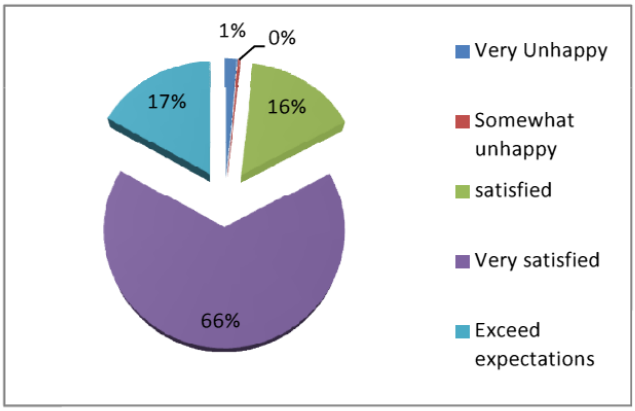
Exit Surveys conducted by BGC which were completed by 464 participants of workshops (GRDC and CRDC funded) using the Paper Based Surveys and the Turning Point Polling System showed that:

- 98% of participants were at least satisfied with the workshop (venue, timing, resources, presenter),
- 83 % were at least very satisfied, and
- 17% suggested the workshop exceeded their expectations
- 93% of participants said they obtained new information by attending the workshop and would recommend the workshop to people they know.

When asked to describe their overall level of satisfaction with the workshops, participants from the workshops specifically run for cotton growers and their neighbours that were jointly funded by CRDC and GRDC provided the following responses (this combines data from the early paper based surveys and later data collected using the turning point polling system):

11.) Discribe your overall Level of satisfaction?

	Responses	
Very Unhappy	7	2%
Somewhat unhappy	1	0%
satisfied	72	16%
Very satisfied	306	66%
Exceed expectations	78	17%
Totals	**464**	**100%**



*It is expected that the 2% which indicated they were very unhappy included a high level of error where participants had pressed a response of 1 using the turning point polling system (thinking it was the highest ranking, not the lowest). Only 1 of the 312 respondents on paper based surveys indicated that they were less than satisfied with the workshop.

The level of satisfaction demonstrated by the participants in these workshops closely reflects that obtained from other workshops delivered by BGC in the GRDC funded project delivered in the Northern and Southern Regions.

A summary of the evaluation data collected from workshops is included in appendix 2b of this report.

Cash and In-Kind Contributions towards workshops

GRDC CASH CONTRIBUTIONS

48 workshops delivered to growers and advisors were co-funded by GRDC.

GRDC CASH contribution towards these workshops was @ 50% ($1800 + GST) per workshop	$86,000+GST
GRDC CASH Contribution towards the Drift Study	$40,000+GST
TOTAL GRDC CASH	**$126,000+GST**

NON CRDC IN-KIND Contributions

The additional 11 workshops delivered were regarded as an in-kind contribution from **BGC** to the project valued at @ $4000 + GST per workshop.	$44,000+GST

Other In-Kind contributions from industry towards the 59 Workshops for 1149 growers and advisors

Facilitator time (@ $800+GST per workshop)	$47,200+GST
Industry Resources (@ $22+GST per participant)	$25,278+GST
Catering Costs (@ $24+GST per participant	$25,576+GST
Venue (@ $175+GST per workshop)	$10,325+GST
TOTAL NON CRDC IN-KIND	**$154,379+GST**

Total Cash and non CRDC Contributions	**$280,379+GST**
Actual CRDC CASH Contribution*	$208,800+GST

*The CRDC cash contribution to this project equated to 42.7% of total budget (excluding CRDC in-kind).

Objective 3: Update Application Sections in Industry Publications.

BGC provided input for several industry publications though out the life of the project which included:

- The myBMP pesticide application module review and update
- Cotton Pest Management Guide (application section)
- Cotton Production Manual (application Section)
- Contributions to Cotton Map Reviews
- Grains BMP pesticide application module (to harmonise with cotton)
- Auschem Chemical User Accreditation Manual (Application chapters)
- Chemcert Australia Chemical User Accreditation Manual (Application and Environment chapters).
- Code of Practice for Summer Spraying (SA)
- Continual updates to Workshop materials and resources
- Numerous GRDC factsheets (mentioned in publications)
- Kondinan Research Report No 29, June, 2012 (Nozzle Selection)

It is my belief that future updates of industry publications should require some industry feedback and guidance regarding potential changes or improvements required to ensure that growers issues are addressed in subsequent editions.

Objective 4: Complete 6 demonstration trials over the 3 year period

7 trials were completed during the project.

A total of 3 trials evaluating the in-field deposition of Weedseeker® units resulted in a change to the recommended nozzle setup and mixing rates being issued by Crop Optics, the manufacturer of the Weedseeker®.

These results were published on the ispray.com.au website, in the crop optics literature and on their website, as well as in industry newsletters and were disseminated at the workshops delivered by BGC. A copy of the article is included in appendix 5 of this report.

The changes to the nozzle type initiated by BGC meant that growers and advisors no longer had to utilise potentially off label rates of product when using the machine (Originally the manufacturer recommended using 1.3 times the label rate, this is no longer the case).

A total of 4 other replicated efficacy based trials evaluating drift reduction techniques for Roundup Ready herbicide applications were completed by Agrisearch.

Treatment lists and results of the efficacy based trails conducted by Agrisearch are included in appendix 4 of this report.

This series of trials demonstrated that in solid plant situations (1 metre row) that a reduction in efficacy was possible when Roundup Ready Herbicide was applied using an extremely coarse spray quality (as compared to a medium or coarse spray quality).

Whereas the most recent trials conducted in wider row systems, such as 1.5m row spacing, there was no apparent reduction in efficacy using the extremely coarse spray quality (using a TTI 015 or 02 nozzle at pressures of 4 bar or greater at application volumes of 50L/ha and 70 L/ha).

This information has been included in workshops for cotton growers, and presented at industry meetings, such as GRDC updates, Glycom and the CCA Cropping Solutions seminar.

Summaries which referenced this data were also published in articles included in: Ground Cover Magazine, Grains Outlook, the Queensland Country Life and The Land, The Cropping Central Newsletter, and at GRDC updates throughout the country.

Objective 5: Deliver 6 train the trainer workshops (2 per year)

A total 6 workshops (professional development presentations) were provided to trainers in NSW and Qld (not all listed on previous calendar) as a part of Chemcert NSW and Auschem Qld's annual professional development workshops. (e.g. BGC presented at 2 workshops per year, over the 3 year period).

During these sessions information on application and drift management techniques was delivered to more than 154 participants (with some trainers attending more than one session over the three year period).

An additional 2 train the trainer workshops were run in conjunction with the GRDC project.

More than 10 trainers (4 from Qld and 6 from NSW) also participated in the workshops delivered to cotton growers during the project, and were provided additional resources and information to better prepare them for delivery of training to cotton growers. It is intended that these trainers will form the basis of future train the train programs to up-skill at least 3 high quality trainers for the cotton industry.

BGC also reviewed and updated the training resources and assessment items for the chemical user accreditations delivered by these providers.

BGC also completed chemical user accreditations in Qld and NSW to evaluated the current standard of training, which will be used to inform future professional development sessions with training providers.

Comments on the Train the trainer program 2009-2012

The aim of this part of the project was to work with, and up-skill, trainers that currently deliver the chemical user accreditations.

This involved providing professional development sessions for trainers at their annual PD workshops and conferences, and having selected trainers participate in the workshops delivered to cotton growers. It also involved rewriting sections of their training manuals and reviewing and updating some of their resources.

The aim was to have the Chemcert trainers commence delivery of the application and drift management workshops as a reaccreditation option by late 2011 into early 2012.

As an interim measure (before Chemcert would commence delivery) participants in the workshops delivered by BGC were provided with the option to complete their chemical user accreditations as a home study option after attending one of my workshops, this option was only utilized by a small number of participants.

A memorandum of understanding was drafted with Chemcert Australia (in July of 2011), which was to enable this process to commence. However, the MOU was not signed by BGC due to the restrictive (exclusive) nature of the agreement sort by Chemcert Australia Ltd.

During the process of further negotiation regarding the handover of the BGC developed application and drift management course to Chemcert Australia Ltd to deliver as a reaccreditation option, the disintegration of the national Chemcert group took place.

Chemcert Australia (also know by Chemcert NSW and Chemcert training Group) undertook legal action against the state based Chemcert groups to prevent them from using the Chemcert Name and Trademark. Subsequently Qld, Vic and WA now operate under the name of Auschem Training.

The action taken by Chemcert Australia Ltd meant that there was no longer a national group that BGC could negotiate with as a single entity, and a single agreement (MOU) with Chemcert Australia (NSW) would have prevented BGC from establishing similar relationships with the other state training entities.

Hence, the way in which BGC had intended that the program could be rolled out had changed substantially (which BGC had indicated as a possible risk at the start of the project). However BGC continued to pursue a path forward, negotiating with each state based organisation.

In October 2011, GRDC put out their tender documents for the delivery application and drift workshops nationally. The training providers sensed that the training

would continue to be delivered for free or at low cost, meaning that a specialist reaccreditation focusing on application and drift management would not be a financially viable enterprise for them to deliver.

Hence by the end of the project, June 2012 the delivery of the workshops by the existing training providers was in a state of limbo, and the delivery of reaccreditation courses as a commercial venture was delayed, due to the subsidized GRDC training through the national project they have contracted.

Objective 6: Attend and give presentations at 3 industry functions per year

Some examples of presentations given by BGC at industry functions include:

2009-2010

- BGC gave presentations at GRDC updates in Dalby and Narrabri, and at the Glycom Seminar at Goondiwindi.

2010-2011

- BGC gave presentations at the cotton trade show seminars, The NSW Ground Sprayers Association annual workshop, and at 6 presentations at the Precision Spray Application Workshops regarding changes to the Weedseeker® setup.

2011-2012

- BGC Presented at the CCA cropping solutions seminar (Moree), Presented at the Australian Ground Sprayers Association annual conference (Adelaide), The Landmark Annual Farm Service Conference for advisors, at two GRDC advisor updates in NSW, and presented at a national adjuvants conference in WA.
- BGC also presented updates to cotton growers and advisors at 2 breakfast meetings in the lower Namoi and Border Rivers.

Objective 7: Participate in up to 6 meetings with industry and regulators per year

BGC represented by CRDC and GRDC at industry meetings, such as:

- BGC participated in the PSIC review as a part of the productivity commission report into harmonisation of training and licensing requirements (3 meetings).
- BGC participated in meetings of the National Working Party for Pesticide Application (4 meetings).
- BGC attended a national workshop on application technique in Victoria.
- BGC contributed to the NWPPA review of Training and Licensing conducted by John Kent.

- BGC continued to provide support to the technical committees of state based organisations delivering chemical user accreditations (4 meetings, plus numerous teleconferences).
- BGC assisted with the development of the Code of Practice for Summer Spraying in South Australia (3 meetings).
- BGC has participated in meetings related to the development of new qualifications for chemical users (at least 4 meetings).

Objective 8: Steering Committee Established and meets on a regular basis

The steering committee was formed in 2009, and met in Sydney on 3 occasions during the life of the project.

The committee was made up of GRDC managers and panel members, representatives from CRDC and Cotton Australia, Industry Representation from Nufarm, DEEDI Qld, and cotton grower representation by Amanda Gilmore from Merah North, NSW.

At each meeting the committee members were supplied with detailed project reports on activities related to both CRDC and GRDC funded projects.

It is my opinion that the steering committee provided more of a review role, than one of actual ‘steering’ of the project. Apart from my direct contact with the GRDC and CRDC personnel, there was little communication from the committee outside of the scheduled meetings.

I believe it would be more valuable to include greater grower and industry representation if such committees are utilised in the future, so that they can provide more guidance on industry requirements from the project.

Outcomes

Describe how the project's outputs will contribute to the planned outcomes identified in the project application. Describe the planned outcomes achieved to date.

a) technical advances achieved (eg commercially significant developments, patents applied for or granted licenses, etc.);

We have been able to establish that coarse spray qualities do maintain efficacy, and will reduce drift potential under suitable conditions for spraying.

We have also gone some way to improving the understanding of Inversion Risk for Spraying.

BGC commissioned Graeme Tepper to write the first edition of the Meteorology for Pesticide Application manual, which was distributed at all workshops. This publication has is now being reproduced by GRDC for distribution to the industry.

Our understanding of the impact of stability and the incidence of inversion conditions has improved, with new APVMA and industry guidelines published related to the risks associated with night spraying. However this is an area that requires further work to clarify to impact of inversions on local weather events in the various cotton growing regions.

b) other information developed from research (eg discoveries in methodology, equipment design, etc.); and

The methodology used for the spray drift study which utilised a range of cations and mass spectrometry (in place of traditional fluorometric methodologies) proved to be a useful, relatively low cost method for estimating drift potential from multiple applications under differing environmental conditions.

The results of this trial were passed on to the National Working Committee for Pesticide Application for further consideration.

c) required changes to the Intellectual Property register.

None identified

Conclusions

- Quality training and technical support does encourage spray operators to change their practice (as evidenced in the Mauroche Report 2010, attached in the appendices of this report), hence a process of continual improvement in the quality of the training programs available will help to provide longer term change in how, and when, spraying takes place.

  However, it is likely that the incidence of spray drift events affecting the cotton industry will continue at varying levels of severity until legislative changes (such as specific requirements to access or use phenoxy products occurs) and better enforcement of label requirements occurs. Continued participation by CRDC in the National Working Party for Pesticide Application is essential to remain up to date with progress in this area and possible changes to legislation.

- Continued support for research that addresses the major contributors to spray drift is required: As an industry, I believe we have a good understanding of the techniques that can be employed by applicators to reduce their drift potential, which is now becoming widely accepted. Where we currently lack quality information is in the understanding of "Local weather events that occur overnight", particularly in the cotton growing catchments.

  Our current understanding of surface temperature inversions suggests that night spraying (between sunset and sunrise) poses an unacceptable risk of off target movement of air borne droplets when the wind speed is below 11-12 km/h (and possibly at higher wind speeds). The movement of airborne droplets at night will be substantially further, and at higher concentrations, than at equivalent wind speeds during the day time, when the ground holds sufficient heat to encourage turbulent air flows.

  It is likely that the development of surface temperature inversions and "local weather events" between sunset and sunrise will be different in each of our growing regions', hence the risks associated with night spraying will also be different in each of those regions.

  We currently lack the ability to identify safe spraying times (at night) . This is an area of research that should be supported across all agricultural industries.

- To continue to address the problems associated with spray drift will require an industry wide approach. The greatest practice change is likely to occur through the use of area wide approaches (where growers have ownership of the issues), and through advisor/consultant driven involvement. From an extension point of view, I believe CRDC should continue to support and encourage the development of AWM groups to facilitate extension activities, and strongly support advisor driven participation of growers in extension activities.

- As a result of this projects collaborative approach with the GRDC, the grains industry is establishing a national program for training in application technique and drift management. Continued involvement and interaction with other RDC's will be essential to ensure that issues related to spray drift management remain a whole of industry issue.

Extension Opportunities

Detail a plan for the activities or other steps that may be taken:

(a) to further develop or to exploit the project technology.

It would be useful to maintain the capacity to respond to industry requests for training and information, given the number of new growers, and growers returning to cotton after some absence. Hence retaining some extension capacity in this area will continue to be a requirement, until the human capacity and commercially available services and training are deemed to be adequate.

In future projects it is planned to further develop the current application and drift management course into an AQF accredited course suitable for reaccreditation (the actual units of competency selected is still subject to the findings of the NWPPA review due for release in July 2012).

It is also planned to develop and mentor at least 3 skilled trainers to deliver this program to specifically tailored for cotton growers, such that the program ultimately becomes user pays and self sustaining.

(b) for the future presentation and dissemination of the project outcomes.

The materials developed in this project have been disseminated nationally, and the training materials are currently being used by training providers in all states of Australia.

The success and participation in the workshops delivered in the first year of the project highlighted the value of an area wide approach, driven by growers, to address issues of regional importance (which must include spray drift management). Future delivery of extension and training activities related to spray drift reduction would greatly benefit from the establishment and support of area wide groups and greater support for advisor driven activities.

(c) for future research.

I believe future research should focus on:

- Understanding the impact of ‘local weather’ on drift potential, and practical ways growers can identify suitable and unsuitable conditions for spraying
- Increasing grower and advisor understanding of the practical methods for drift reduction
- Improved efficiency of spraying operations that can be implemented by growers (making the most of suitable conditions for spraying), and maintaining or improving efficacy, and
- To what extent the spray equipment used by the cotton industry may meet international sprayer testing standards (e.g. demonstrate sustainable practices) in

preparation for potential changes in rules imposed by importing countries, such as the members of the EU.

Future extension must place a value on the growers available time for attending training opportunities by maximising accreditation potential and linkages to other extension projects (e.g. IWM).

A. List the publications arising from the research project and/or a publication plan.

Application and drift management workshop resource materials.

GRDC Factsheets:

- *The Back Pocket Guide – Nozzle Selection for boom, band and shielded spraying*
- *The Influence of Surface Temperature Inversions on Spraying Operations*
- *Weather Monitoring Equipment for Agricultural Spraying Operations*
- *Water Quality for Spraying Operations*
- *Mixing Requirements for Spraying Operations*
- *Pre-season Sprayer checks and controller settings*
- *In-crop herbicide applications*
- *Foliar applications of spray*
- *Practical Tips for Drift Reduction*

A selection of Industry Articles:

Have you read a label lately? Crop Consultants Australia Cropping Solution Seminar, 2012

Kondinan Group Research Report No.29: *Nozzle Selection Pays Off*, June 2012.

Hitting the Target – Optimising Group L applications. Cropping Central Issue 53, February 2012

Grains Outlook: *Coarse Spray Survey dispels efficacy worry*, February, 2012

Considerations for foliar applications of pesticide. Advanced Agronomy Conference Proceedings, Edmonton, Canada, November 2011.

Where can we make gains in application efficiency? GRDC Ground Cover magazine November 2011.

Speed and Pressure important for Nozzles, The Land, August 25, 2011

Proactive on Spray Drift, The Land, June 2, 2011

Ten tips for Fungicide Application, Cropping Central Issue 50: June 2011

Achieving Good Pre-emergent spray results, Cropping Central Issue 50: June 2011

The right numbers for Banded Sprays, Cotton Spotlight Autumn 2011:

Nozzle Know-How, The Land, February 24, 2011

Tips to minimise spray drift, GRDC Southern Advisor Updates 2010

Don't Kill Your Neighbours Crop. Ground Cover May-June 2010

Factors Affecting Efficacy. NSW Ground Sprayers Association, March 2010 Workshop Proceedings

Nozzle Section for Drift Management , South Australian Ground Sprayers Association Workshop Proceedings, March 2010, Proceedings

B. Have you developed any online resources and what is the website address?

Yes, nozzle selection tool: ispray.com.au (toolbox)
Banded spray calculator: ispray.com.au (toolbox)

Part 4 – Final Report Executive Summary

Aspects of this project were delivered in collaboration with the GRDC project BGC00001 "Raising awareness of drift reduction techniques."

Workshop Program for Cotton Growers and Their Neighbours (co-funded by GRDC)

A total of 53 application and drift management workshops were delivered to 1046 cotton and grain growers, with independent evaluation showing more than 80% of the participants surveyed had changed one or more practices within 3-6 months of attending the workshop.

Exit Surveys showed that 98% of participants were at least satisfied with the workshop (venue, timing, resources, presenter), 83 % were at least very satisfied, and 17% suggested the workshop exceeded their expectations.

95% of participants said they obtained new information by attending the workshop and would recommend the workshop to people they know.

A further 6 workshops were provided to 103 advisors, and 6 workshops for trainers were delivered to more than 154 participants (an additional 2 of the trainer workshops were run in conjunction with the GRDC project).

The external cash and in-kind contributions to this project were 1.34 times greater than the CRDC cash contribution.

Application and Drift Management Trial Program

The workshop program was supported by 7 application trials, with the data obtained used to modify training materials and was presented to growers and advisors at industry meetings and updates. 3 Trials resulted in a change to the WeedSeeker® setup by the manufacturer, 4 separate efficacy based trials demonstrated that coarse droplets do provide equivalent efficacy for many types herbicide applications, and that the use of coarse droplets was effective in fallow situations for phenoxy and glyphosate products. Trials indicated that in wider row situations (1.5m) efficacy could also be achieved with Roundup Ready Herbicide, however the use of extremely coarse droplets for over the top Roundup Ready® applications had the potential to reduce efficacy in 1m row, solid plant situations.

A single study evaluating relatively new techniques for measuring spray drift (comparing daytime and night time spraying) highlighted the risks associated with night spraying. The methodology used for the spray drift study using a range of cations and mass spectrometry (in place of traditional fluorometric methodologies) proved to be a useful and relatively low cost method for estimating drift potential under differing environmental conditions.

The results of this study were passed on to the National Working Committee for Pesticide Application for further consideration.

Take Home Messages

Minimising spray drift continues to be a challenge for all agricultural industries. The cotton industry, through its long term support for training and extension in drift management has been able to act as a catalyst for establishing a national program for delivering the application and drift management workshops developed by BGC. GRDC will be funding the delivery of this program nationally to grain growers for the 2012-2015 period.

The challenge for the cotton industry will be to maintain its status as an industry leader in extending information related to application and drift management.