SARDI
SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

Government of South Australia
Primary Industries and Resources SA

Australian Government
Grape and Wine Research and Development Corporation

Dr Andrew Landers visit to Australia to present regional workshops on improving spray application



FINAL REPORT to

GRAPE AND WINE RESEARCH & DEVELOPMENT CORPORATION

Project Number: **GWT 08/02**

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Research Organisation: **South Australian Research and Development Institute & Cornell University, USA**

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1 ABSTRACT

Dr Andrew Landers, of Cornell University USA, delivered 16 workshops in five states of Australia on effective spray application. A world expert with 35 years experience in agricultural engineering, Andrew Landers provided information, backed with sound research, on the use of techniques for monitoring and adjusting airflow and direction to improve spray deposition and reduce drift. Workshops were organised by Mark Sosnowski (SARDI) and Duncan Farquhar (NWGIC) in coordination with regional grower associations and were attended by 612 growers and industry personnel. In summary, nozzle selection and orientation, airflow regulation and the use of tracers to assess deposition and spray drift will improve the efficiency of spray application. Initial feedback to the workshops was overwhelmingly positive and an online survey indicated immediate uptake of information and adoption of techniques following the workshops. The general feeling of growers was typified by the quote “science delivered in everyday language”. In conclusion, growers are recommended to follow up and adopt ideas presented by Andrew and there is more demand for similar nationally focused workshops particularly in the area of vine health and recommendations from this experience will enhance future such projects. The outcome of this workshop series has been an important increase in the capacity of the Australian wine industry to sustain production and protect assets by managing vine health.

2 EXECUTIVE SUMMARY

Dr Andrew Landers is a faculty member of Cornell University, based at the New York State Agricultural Experiment Station in Geneva, NY USA. He leads an application technology program involving the use of engineering solutions to provide safe and efficient spraying. Andrew has conducted research leading to growers improving the efficiency of spraying with minor (inexpensive) modifications to existing equipment using simple techniques to measure airflow, spray distribution, deposition and drift. This work has lead to reductions in pesticide use in USA necessary for controlling diseases and pests and reduced the potential impact on the environment.

With funding from GWRDC and Cornell University, Andrew Landers travelled to Australia. The visit was organised by Mark Sosnowski (South Australian Research and Development Institute) and Duncan Farquhar (National Wine and Grape Industry Centre) in coordination with various grape grower industry associations around the country. The objective of this project was to provide Australian grape growers with valuable information from research in the USA which will improve management of grapevine diseases and pests.

Andrew Landers visited 16 wine regions in five states of Australia and delivered workshops to 612 industry personnel. Indoor seminars and vineyard demonstrations provided knowledge on a range of topics including; i) how droplets are formed and how we can make better use of them, ii) how airflow affects penetration and deposition, iii) inexpensive ways of getting the spray onto the target and reduce drift and iv) developments in vineyard spraying in Europe and North America. In summary, it was concluded that drift is impossible to eliminate but it can be minimized. Implementing methods such as nozzle selection and orientation, airflow regulation and the use of tracers to assess deposition and spray drift will improve the efficiency of spray application saving time, money and future problems. Immediate feedback on the surveys was very positive with reports of 'word of mouth' from early events spreading between regions and bolstering numbers in latter events.

An online survey was conducted by Duncan Farquhar to obtain feedback from attendees and to ascertain adoption of methods and ideas offered by Andrew Landers. Forty-three responses were received from all regions except Tasmania, the Clare Valley or Gundagai. Results show that last season, before attending the workshop, the majority of respondents checked their spray coverage, predominantly using water sensitive paper, which was encouraging. However, the majority of respondents did not check for spray drift last season. Following the workshop, the majority of respondents made changes to the set up of their sprayers. Replacing and changing nozzle orientation was the dominant practice adopted followed by reducing and/or redirecting airflow. One respondent is building a tunnel sprayer. Overall, a little more than half of the respondents changed practices as a result of the workshop. It would be interesting to follow up next year to find out the extent of adoption of these practice changes. Demand for future workshops by respondents revealed nutrition as prominent on the vine health radar along with trunk diseases, especially eutypa dieback. There was an overwhelmingly positive response to the way in which Andrew presented the information and he was really able to connect with the growers which was summed up by the comment "science delivered in everyday language".

Local coordinators of each workshop were also asked for feedback on the workshops and the organization process. Six responses were received. In general, all were very pleased with the content of the workshop and its relevance to the local region. Comments were made on the need for improved communication in regard to planning, budgeting and timing as well as the use of handouts. All coordinators showed great interest in holding similar workshops in the future.

Andrew Landers provided comments on his perspective of the workshop series. He praised the hospitality of local organizers and was very positive about the overall organization of transport, accommodation and other logistics. He commended the growers for their attentiveness and interest in his research. Also encouraging is that Andrew commented in conversation on the superiority of the Australian industry in the area of OH&S, compared to any other place he has visited in the world. In future, the use of handouts to provide follow up material for attendees was also noted. Several areas of future collaboration have been identified during a number of meetings between Andrew and industry personnel during the visit.

Recommendations arising from this project include; i) growers follow up and read Andrews notes and slides and consider the many ideas for improving and optimising spray application, ii) a national spring workshop series in vine health issues should be coordinated by the National Extension Steering Committee and iii) a more detailed hands on training course be developed with collaboration between Australian experts and Andrew Landers. This will lead improved production of grapes in Australia and further enhance its international reputation.

3 BACKGROUND

Dr Andrew Landers studied and taught agricultural engineering in England. He obtained his masters degree at Cranfield University and his PhD at the University of Bath. His thesis work involved the development of a direct injection crop sprayer, leading to variable rate application in precision farming. He taught agricultural students at the Royal Agricultural College before becoming head of the engineering department at Harper Adams University. He joined the faculty at Cornell University in 1998, and is based at the New York State Agricultural Experiment Station in Geneva. He directs the application technology program and his teaching/extension/research appointment involves the use of engineering solutions to provide safer spraying. His group works with application systems in grapes, apples, vegetables and turf grass and he believes in a multi-disciplinary approach to pesticide application, working with biologists to ensure engineering techniques are biologically effective. Andrew Landers is author of the classic textbook, Farm Machinery: Selection, investment and management.

During previous visits to Cornell University NY State Experiment Station in Geneva USA, Mark Sosnowski and Trevor Wicks (SARDI) have met with Andrew Landers, and learnt about new developments in the application of pesticides through commercial sprayers to improve chemical deposition and canopy penetration and reduce spray drift. Andrew has conducted research leading to growers improving the efficiency of spraying with minor (inexpensive) modifications to existing equipment using simple techniques to measure airflow, spray distribution, deposition and drift. This work has lead to reductions in pesticide use in USA necessary for controlling diseases and pests and reduced the potential impact on the environment.

Mark Sosnowski, Trevor Wicks (SARDI) and Duncan Farquhar (National Wine and Grape Industry Centre) hosted Andrew Landers and in coordination with various grape grower industry associations, conducted workshops in each of the major wine regions of South Australia, New South Wales, Victoria, Western Australia and Tasmania.

The objective of this visit was to provide Australian grape growers with information from research in the USA which will improve management of grapevine diseases and pests.

4 WORKSHOPS

Andrew Landers visited 16 regions (Appendix 1) in five states of Australia and delivered a 1.5-hour indoor presentation, followed by a 1-hour field demonstration at each site. Overall 612 people attended the workshops. The indoor sessions involved a Powerpoint presentation which provided data and pictorial evidence for methods developed by Andrew for improving spray application (Fig. 1). Topics covered included:

- How droplets are formed and how we can make better use of them.
- The answer is blowing in the wind - how airflow affects penetration and deposition - how we can adjust airfllow to improve deposition.
- Reducing drift - inexpensive ways of getting the spray onto the target - modifications from $0 to $24,000.
- Developments in vineyard spraying in Europe and North America.

A paper written by Andrew which summarizes all the information presented at the workshops is attached (Appendix 2) along with a selection of the Power Point presentation slides (Appendix 3). The presentation was modified from region to region focusing on the type of spray practices used and the questions asked by attendees. Also of note, Andrew found it best to split the indoor presentation into an introductory section, followed by the field demonstration and then return indoors for a tailored presentation of data with extra focus on questions by the audience.

The field demonstrations concentrated on the typical spray machines used in each region (Fig. 2). They provided live demonstrations of a number of practical ways to improve deposition and reduce drift, such as simple modifications to the sprayer. Andrew also showed attendees how they can tell where the spray is going using a range of simple and effective tracer techniques (Fig 3).

Regional grower groups and government department personnel arranged venues and catering. In some cases, sponsorship was obtained from industry to help cover catering costs, and in other cases grower associations covered costs from membership fees or by a small charge for attendance. This contribution led to the success of funding from GWRDC to cover airfares, domestic travel and accommodation for Andrew.

Further details on the information presented by Andrew can be found at the following websites:

http://www.nysaes.cornell.edu/ent/faculty/landers/pestapp/

http://www.nysaes.cornell.edu/ent/faculty/landers/index.html#pro

http://au.youtube.com/watch?v=D0dNhPVdxPQ

http://au.youtube.com/watch?v=3ZE-NmeXn8w



Figure 1. Andrew Landers delivering the Powerpoint presentation to workshop attendees.



Figure 2. Typical types of spray units used in field demonstrations for the workshops. A. conventional axial air-blast, B. air-blast with small wind deflectors, C. air-blast with tower, D. air-assisted nozzle sprayer, E. single-row Silvan with Cima fan, F. twin-row Silvan with Cima fan, G. twin-row Greentech and H. twin-row Croplands with SARDI fan.



Figure 3. Field demonstrations. A. spray drift, B. providing hands on experience, C. measuring spray drift inexpensively, D. interview by WIN TV Riverland, E. water sensitive paper, F. kaolin clay tracer and G. talking deposition.

5 SPRAY APPLICATION WORKSHOP ONLINE SURVEY

Results and summaries compiled by Duncan Farquhar

An online survey was conducted after the spray application workshops. The survey was designed in consultation by Duncan Farquhar, with Warren Andrews from NSW DPI completing the web formatting and designing the data collection back end. The survey was housed on the NSW DPI server and there was a link from the NWGIC website to these pages (Appendix 4).

Regional leaders who had coordinated the spray application workshops were requested to send a link to the survey via email to their members. The survey was also advertised on Daily Wine News, an email news service from Winetitles. Two hand-held anemometers were provided as prize incentives to complete the survey by Weather Down Under and Instrument Choice. The survey was in the field for one month from 11 November 2008 to 11 December 2008.

In all 43 individuals responded to the on-line survey, representing 7% of the total 612 that attended all 16 workshops. Questions and a summary of responses are listed below.

Did you measure/check your spray coverage last year? If so how?

Answer	Number	%
Blank	6	14
No	8	19
Water sensitive paper	15	35
Visually	7	16
Paper strips and dye	2	5
I ran a workshop demo for growers and we assessed coverage	2	5
Used Surround to check coverage	1	2
Yes/calibration, check list of chemicals used, water volume vs area covered	1	2
Yes via a calibration test of the electronic flow sensor using a 20 L bucket	1	2
Asked the spray operator	1	2
no, contractor did it	1	2

The surprise here is the number of people using water sensitive paper. This shows considerable attention to detail in this area. Eight respondents not checking coverage also shows opportunity for more attention and the ongoing annual need to motivate growers to pay attention in this area. Paper strips and dye response shows some encouraging use of cheaper methods Andrew was advocating.

Did you measure/check spray drift last year? If so, how?

Answer	Number	%
No	18	42
Blank	5	12
Visual	7	16
Used surround to check drift	1	2
Ran a workshop demo and considered drift	2	5
Coloured water / ink jet paper	1	2

A visual assessment of drift is often helpful. The large number of no responses (18) would probably be a result of many vineyards being isolated from places where drift could present a problem. It seems that coverage is a more prevalent question and Surround may be better for checking coverage than drift.

Did you make/use a patternater. Y/N

All no's and a blank. If someone had made one it would be interesting to see how and perhaps ask for a photograph. One respondent said he would make one in Question 6. This may be worth chasing next year.

Have you changed your sprayer setup from last vintage. If so how?

Answer		Number	%
1.	Added a doughnut	0	0
2.	Added baffles	1	2
3.	Changed nozzle orientation	23	53
4.	Changed nozzles	10	23
5.	Changed air	0	0
6.	Other modifications……	8	18
7.	Blank	12	27

Changed spray head orientation for more turbulence (Croplands Quantum Mist)
Currently using Silvan Air Shear with great results, no major changes required
Will be doing the other alterations prior to next season
Reduced speed of tractor PTO to reduce drift
Slowed the fan down [Air blast]
Aligned the heads off centre from canopy
Reduced PTO speed to fan
Made recommendations to growers
Changed fan spacing and orientation
Changed angle of sprayer fans
Building tunnel sprayer
Serviced motor
No changes to my workplace spray unit as its not an airblast unit

For 'Other modifications', seven out of 13 respondents specified responses relating to changes in air even though they did not respond to the tick box about air. Changing nozzle orientation was the dominant practice change by growers since last vintage. I suspect many of these changes would be practice changes as a result of the workshop.

Did you (or someone from your organisation) attend this workshop.

Answer	Number	%
Yes	39	91
No, please comment…….	4	9

Was not able to due to vacation
Could not make it
Not available when held
Was too far away from me, but I have studied the handouts and will consider further

There are no great insights here from people who did not attend except to say that being available in a region in close proximity to where people live and grow grapes will make it easier to attend.

Did you make any other modifications to spray application as a result of attending this workshop?

Two responded yes (plus 16 positive responses below), 10 responded no (plus five below)

Adjusted fan speed
Advice on air blaster setup in relation to jets; air flow volumes on AS
Altered spray pressures to correct droplet size
Decreased maximum speed used
Drop the fan to low speed
Fan Speed for different canopy sizes
Have taken measurements to make doughnuts for next season.

I will be adding both baffles & a doughnut to my own spray unit as it is a air blast sprayer
I will try to make a patternator
Much closer general observation of spay pattern generated
New machine this season, used many of Andrew's tips to set up machine
Novice, only have been doing own spraying from this season
Reduced PTO speed, Reset orientation of nozzles
Slowed PTO speed
Using photo paper to check spray coverage
Yes, fitted Air Induction nozzles to herbicide rig.
Yes, I lowered the PTO speed when the canopy was less dense earlier in the season. I will continue this on our other vineyards next year also to avoid drift.
No, but considered all options. Part problem I think is whether the modifications are worthwhile and efficient. To some extent one might argue that instead of adding baffels and donuts etc it might be better to save time and money and get a more sophisticated sprayer, and to apply sensible use.
No, we were buoyed by Dr Landers presentation that we were doing a good job
Not yet, but will at beginning of next season
Not yet, will measure spray drift
Not yet. Have plans but will require off-season work.

A little more than half of the respondents changed practices as a result of the workshop. The actual practices above are an insight into attendee's decision-making and detailed engagement with the subject matter.

It will be interesting to see what results the person who is going to make a patternator gets next year.

What other topics would you be interested in hearing about in the area of vine health?

Four responded "Any" relevant topic, seven responses below mentioned nutrition

Age effects (as I have 33 yo vines that appear to be losing productivity, but that could be due to stress effects)
Biodiversity
Combating diseases trunk and wood diseases
Compiled information on when, and what to fertilise vines with during the season. At the moment there is a plethora of information from fertiliser companies about their particular products. However, the particular chemical requirements of vines at different phenological stages is not easy to find.
Disease identification
Drought sustainability
Eutypa management, and "what affects fruit set-practical management techniques"
Fertigation-plans and timing.
Flowering and fruit set, how to improve set in chardonnay
Irrigation, especially water relations of soil and vine.
Minimising the number of sprays per season, non chemical control methods
Nutrition
Nutrition and Result interpretation specifically for region
Nutrition and irrigation scheduling
Organic fertilizers
Pest and disease monitoring. Disease resistance to chemicals.
Real water use in relation to stomata activity and plant growth including shoot and berry development.
Restricted spring growth and vine viruses
Scheduling and different products to use
Soil health
Soil microbes or better transformation of urea to nitrate
Treatment of other diseases, especially eutypa dieback.
Vigour management, nutrition
Water management in general

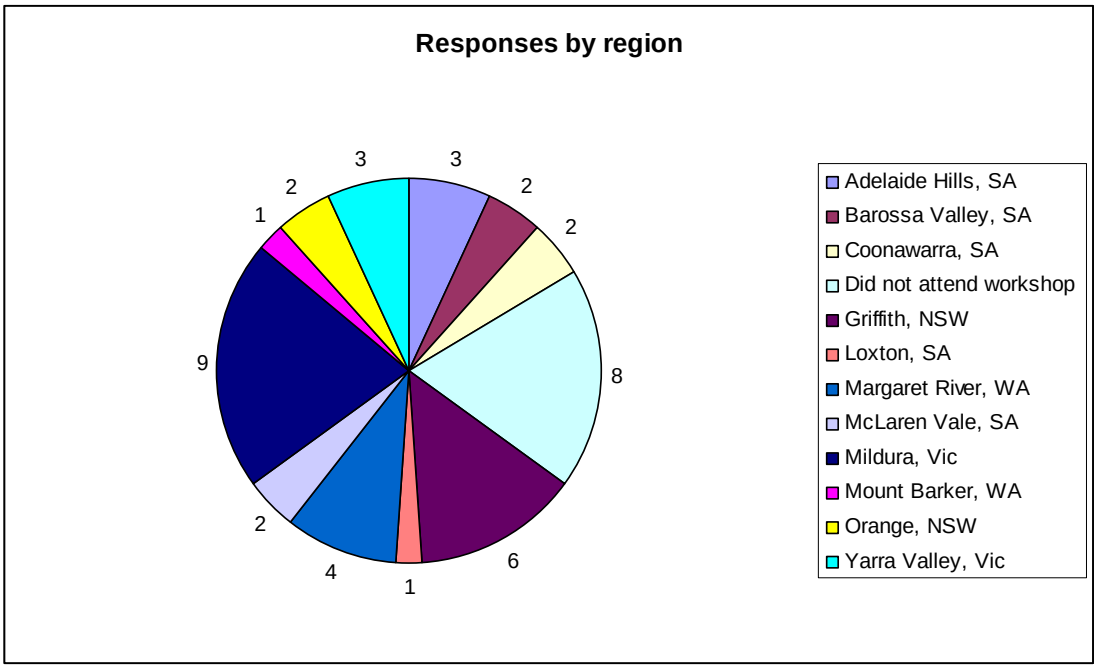
This is a good list of topics for future workshops. It is particularly interesting to see nutrition as prominent on the vine health radar. It is also interesting to see Eutypa dieback and trunk rots mentioned three times.

Do you have any other comments to make about this workshop……

Handouts look very interesting
It was great. Andrews message is straight forward and practical
Very well presented - user friendly
By lowering pressure as suggested saved chemicals
Very valuable
Good reminder
Some great info.
Extremely good and it was disappointing not to see more growers present
Really practical and hands on advice that can make a big improvement with the simplest of techniques that can be used by growers not possessing rocket science degrees-there are a few of like that!
A most down-to-earth person who was only too happy to discuss problems around the bar-b-q.
Good, practical ideas demonstrated.
Very interesting hearing of these techniques and developments
Provided excellent practical information
Excellent workshop demonstrating both cheap easy and more expensive ways to improve spray technologies
Practical and informative
I really enjoyed the workshop. Andrew has excellent knowledge of spray equipment and coverage issues. He presented it in a fashion that people could understand, and had a good sense of humour
This workshop was the BEST workshop I have ever attended, not only for the excellent content but also for the interactive and humorous way in which it was presented
Great presenter
It was excellent - science delivered in every day language
It was a new look at sprayers, thought it had all been covered
The workshop was very valuable in that it revised some fundamental concepts. Since we have an older type air blast sprayer the workshop was particularly appropriate. However I had the impression that many of the issues discussed would have only been of some interest to those with more sophisticated
I found the workshop very useful and informative
Enjoyable presentation, especially presenter style
Excellent - I learned more at this workshop than at uni.
Very informative
Excellent (cheap) ideas on spray pattern monitoring
Great presentation, fun, informative, well delivered and very practical.
Well presented, practical info,
Will be making a "vine box" for my air blast over winter
Packed with useful tips we farmers can use!!
Most informative workshop I have attended. Plain talk with simple and practical ideas for improving spraying.

This is overwhelmingly positive showing Andrew was really able to connect with the grower group in an area of daily practicality. This is perhaps the best expression of thanks to Cornell for contributing Andrew's time to share experiences with growers in Australia.

Summary of respondents:
13 vineyard managers responded
18 owner operators responded
12 others responded and listed themselves as below
3 consultants
Viticulturist
Vineyard Hand
Chief Viticulturalist
2 Technical Officers
Grower Technical officer
Vineyard spray contractor
Vineyard Maintenance Supervisor and OH&S rep.



Responses were widespread although there were no responses from Tasmania, the Clare Valley or Gundagai. There was a mix of owner operators and managers as well as a range of consultants and advisors in attendance.

6 COMMENTS FROM REGIONAL COORDINATORS

Leaders of regional groups were also asked about how this process went. Six responses were received. These comments are also collated below.

Diana Fisher Margaret River and Mt Barker WA

1) How things went for you
The presentations were well received by growers in WA with about 60 participants in Mount Barker and 70 in Margaret River. The industry support we had to fulfill the workshop requirements was fantastic. Cape Mentelle and Great Southern Landsdale both gratefully provided their vineyards and equipment for the practical demonstrations and Nufarm Australia provided the catering for both venues.

To ensure future functions operate more smoothly please note the following points:
- The seminar section was considerably longer than we had been informed. It actually ran for about 2.5 hours rather than 1 hour at both venues.
- It is preferable that participants receive handouts at the extension activity rather than receiving this information several weeks later. I have also been informed that some of the information presented by Dr Andrew Landers is absent from the website information provided.
- It would be useful to have a direct link with the presenter (ie. mobile or/and e-mail), especially for when they are in WA.
- Some prior input to the dates would be useful to ensure the extension activity does not clash with local activities.

This next point is not always practicable but it would be useful for some additional training by one or more persons within the state/region to assist with follow-up implementation (ie. some participants are interested in applying Dr Andrew Landers research but they would like some additional assistance with this).

2) Would you like similar nationally coordinated help with speakers for a spring vine health workshop in future.

Yes a national coordinated approach is a brilliant idea. This is how the RtoP workshops originally operated and it worked really well.

3) Would you do anything differently in the future.

It would be very useful to have a more direct link with proposed nationally coordinated extension activities. The WIAWA Technical Committee at their meeting on 31st October specifically requested that where practicable a range of topics be provided at extension activities. This does occur on many accessions but was a missed opportunity on this occasion.

I hope these comments help with future nationally coordinated activities.

Leo Quirk Gundagai NSW

1) How things went for you -
Successful day very practical and pitched at the right level however we were left a bit out in the cold in reference to funding for meal and the clay for the effective tracer techniques.

2) Would you like similar nationally coordinated help with speakers for a spring vine health workshop in future.
I think its a great idea as long as we have presenters who are engaging and presenting on issues that are important to the regions that workshops will be conducted in. It is OK to subsidise costs of travel but a very important part of the last field day was the chance for growers from other regions to chat to each other on a very sociable level about the industry and the coming season.. To me that was the real key to this being a very successful workshop.

3) Would you do anything differently in the future.
More consultation on a regional level so we can really meet the market demand.
Also when budgeting is done costing venues, meals etc should be included.

Kristy Bartrop Griffith NSW

1) How things went for you
The feedback received from the seminar was positive. The field demonstration gave the growers the hands on application that could be taken away and used in their vineyard.

2) Would you like similar nationally coordinated help with speakers for a spring vine health workshop in future.
Yes. The timing of the visit was also good.

3) Would you do anything differently in the future.
Perhaps in future have the Australian specialists to speak on their findings.

Amy Richards McLaren Vale SA

The workshop was extremely well received by McLaren Vale growers and we would love to be involved in a spring vine health workshop.

No suggestions.

Nigel Squire Mt Benson SA

1) How things went for you
Everything went well both on an organisational side and then the delivery of the information, we had rain on the day so the field demo was cancelled with some impromptu demo done on a concrete pad which had good results

2) Would you like similar nationally coordinated help with speakers for a spring vine health workshop in future.
Yes anything along the same lines of delivery would be of benefit, we are a small region and miss some of the larger seminars coming to us so this format worked well.

3) Would you do anything differently in the future.
No all seemed to be well received with no great need for change.

Jeremy Bright Orange NSW

1) How things went for you -
Successful day very practical and pitched at the right level. Funding should have been factored into the project as I was unsure as to who would pay for food and drinks.
Generally a good field day happens when the lecture and practical are given and growers can discuss over a few snags and drinks...This is the real value and the creation of a move towards practice cultural change eg I'll do it if you will.

2) Would you like similar nationally coordinated help with speakers for a spring vine health workshop in future.
I think its a great idea as long as we have presenters who are engaging and presenting on issues that are important to the regions that workshops will be conducted in. I think also that more thought needs to be put in catering for all regions. Some will miss out quite regularly. I know Orange use to miss out a far bit and sessions use to go to Cowra which climatically is a different region with perhaps different issues. Just factor in social aspect as well and not just the travel side of it. You really only need an extra $200-300 which doesn't sound allot in the grand scheme of things but when you realise that the District horts are running on a tight budget it does help us enormously in planning.

3) Would you do anything differently in the future.
More involvement from local knowledge ie give them an opportunity to speak.
Also when budgeting is done costing venues, meals etc should be included.

7 COMMENTS FROM ANDREW LANDERS

The events were well coordinated by Mark, Duncan and the extension team. I arrived on time for each presentation and was extremely well received by the host(s) at each venue. I had time to talk to a few growers before the presentation and to discuss their local conditions. The agenda was very full, 16 talks in 30 days was quite a pace, but was personally and professionally very rewarding. The growers were fantastic, like grape growers all over the world they were attentive, interested in the subject and preferred to ask questions on an individual basis.

I frequently had a good display of sprayers, with very cooperative tractor drivers. Having given the presentation so many times, I was guilty of not fully explaining the course of events to some drivers but we managed to muddle through. I had a good cross-section of old and new sprayers, from old air blast sprayers to Sardi fans and Greentech machines – an ideal spread for demonstrating.

In 99% of the venues I had a great presentation room, ranging from wine cellars, to farm workshops to college lecture rooms. The room at Hobart was a problem as excess daylight through large winery windows made seeing the slides difficult, until a temporary screen was assembled. Margaret River was a problem as it was a lecture room with tables separating all growers from the speaker, too formal.

Frequently the meeting was followed by refreshments – this gave plenty of opportunity for individual or small group questions plus an ideal opportunity for me to learn about their vineyards. The food and company was always good.

Some extension people introduced me using their own style which was interesting to observe, others were more formal and had read the handout! In all cases everyone was a pleasure to work with.

Travel was well arranged and always appeared seemless. Hotels were extremely comfortable although I personally prefer the peace of the countryside, I can see merit in being centrally located.

I gave two radio interviews, at Mildura and Margaret River and one television interview at Loxton. Good press coverage before the event in the Grapegrower and winemaker and post tour in Australian Viticulture.

Time became a problem, the more one presents a similar talk, the longer it gets. I believe the growers didn't mind but constraining the information into one hour was difficult.

The major oversight in this modern electronic world was the use of handouts. I appreciate growers like handouts and I should have brought some, I relied too much on the web page and appreciate that this isn't favoured by all. My powerpoint is on the web page but I could have printed it out.

I made good contacts, both in the winegrape industry, the research community and with sprayer manufacturers. I hope to remain involved with the research community. My presentation can be adapted to meet the requirements of the apple industry and offer a repeat exercise, one day.

Overall it was a fantastic opportunity to travel around Australia, to learn from grape growers of their experiences and to meet wonderful people. The wine was excellent with time for visiting cellar doors and tastings. I personally had a good mix of work and play and thoroughly enjoyed both.

I am extremely grateful to GWRDC for funding my visit and to Cornell University for giving me the time away. I also wish to thank SARDI and GWRDC for allowing Mark and Duncan the time to escort me, particularly during the early part of the tour. Above all I wish to personally thank Mark and Duncan for all their efforts in arranging this tour, it requires a lot of work before, during and after, I am grateful and hope to reciprocate someday.

Suggestions for improvements for next time:

The two main areas are both with communications. A radio interview could be distributed to the regions and more press releases to local farming newspapers. Handouts – a must.

8 COMMENTS FROM DUNCAN FARQUHAR

The grower comments speak for themselves about the resonance that this workshop had and I add my thanks to the regional organisers, to Mark Sosnowski, to Andrew Landers and Cornell for being so easy to work with. GWRDC were also very helpful in encouraging this workshop to be coordinated nationally and I am sure their $12K contribution delivered considerably above the investment. The National Extension Coordination committee opened doors and were also enthusiastic in support. The can do attitude of all the people involved was seamless.

Spray application is core business for grape growers but it is only part of the task of protecting vineyard assets from disease and optimising the biology and ecology of our industry. Sprays and spray application are a significant cost for vineyards. Around $250/ha for sprays and 1000/ha for spray application[1] equates to around $43M for sprays and $173M for application costs (excluding capital) across Australia's 173000ha[2]. A 1% impact in this area is worth over $2M. Attention to detail in spray coverage will give better disease control results so grower attention to this area is probably proportionally greater than the cost proportion. However it is also important to improve the many other industry activities protecting vineyard and wine assets from biological threats. I have previously written about a continuum of vine health from soil to stomach and bunch to border[3] as a framework for understanding our capacity in this area.

The industry capacity to manage vine health is vital for sustaining grape production and protecting industry assets. Measuring this capacity will enable prioritisation of investments to increase this capacity. It will also allow us to understand the effectiveness of interventions to increase capacity and beware of any erosion of capacity. The Winegrowing Futures Program has surveyed aspects of vine health management practices in NSW[4]. Such measures and the evaluation survey from this workshop provide a patchwork of understanding of this vital industry capacity. Industry leaders in vine health can encourage reporting evaluations of vine health interventions to piece together measures of the outcomes of their activities in terms of sustaining and building this capacity.

The feedback from this workshop showed strong support for such nationally coordinated activities and that the spring timing suited growers as a time to think about vine health issues. The comments from feedback have been carefully considered in making recommendations below.

Some comments above about Australian work in spray application should not be ignored. Allison McGregor, Geoff Furness, John Kent and the Centre for Spray Technology Application Research And Training in Queensland would be on my radar in this space. Croplands and the Tasmanian Aus-Industry project looking at building covered sprayers is interesting in the area of the design of the capital assets. This is especially so in the light of blue-sky ambitions envisioned with Andrew to engineer the operator out of the system. I am sure I have missed people out here but I would like to say that in line with the recommendations below I would welcome future extension contributions from within Australia in this important area.

The online feedback form was a useful way to get information back from participants. The response rate for a survey that was live for a month was OK given the resources contributed to this. Thanks to Charles Sturt University and the New South Wales Department of Primary Industry for making this possible. The prizes of hand held anemometers served a dual purpose of encouraging people to adopt one of Andrews recommendations to measure and record wind speed and direction and to encourage people to fill out the survey. Thanks to Instrument Choice and Weather Down Under for coming to the party. A grower in the Yarra and another in the Barossa were well pleased with these Christmas time surprises. I encourage growers to fill out these forms as they are very useful for us in understanding how to best meet your needs.

I would also like to acknowledge Casey Littlejohn from Travel Leaders in Wagga Wagga. She did a great job of organising Andrews itinerary.

In concluding I would like to echo Andrews comments about enjoying the interaction with growers. The industry people contributing to the organisation and contributing to discussions made this project a success.

[1] Garth Swinburne 2008, Personal communication
[2] ABS 1329.0 2008 Released 28/11/2008
[3] Farquhar 2008 "The Vine Health Continuum: What's your responsibility" *Australian and New Zealand grapegrower and winemaker,* ISSN 0727-3606, Nº 537, 2008 , pgs. 40-42
[4] Quirk, L et al 2008, "NSW Grape Grower Production and Cultural Practice Survey 2007" NSW Department of Primary Industries ISBN 978 0 7347 1946 1

9 MAIN OUTCOMES

9.1 Collaboration

- Whilst in Adelaide, Andrew Landers met with Richard Smart (Smart Viticulture), Sean Mulvaney (Croplands) and Tim Gale (University of Tasmania). The purpose of the meeting was to discuss collaboration on an Ausindustry project which aims at minimising spray drift and environmental contamination from vineyards using tunnel sprayers.
- Mark Sosnowski and Adrian Loschiavo discussed the use of computer software which has been adapted for assessing spray coverage on leaves by Andrew Landers' group at Cornell University. It has excellent potential for assessing spray coverage on pruning wounds for the prevention of eutypa dieback which will be incorporated into commercial spray trials in future research.
- The feedback received from workshop attendees has revealed a need for further training in the area of spray application, with interest shown by many for more detailed training. Andrew Landers conducts 1½ day hands-on training in the USA and is keen to collaborate with the Australian industry to develop similar training for Australian growers. This could be achieved through Andrew returning to deliver the training and/or training local industry personnel to deliver the training.

9.2 Knowledge

A great deal of information was presented by Andrew Landers and has been included in the Appendices of this report. The online survey gives testament to the amount of knowledge gained during the visit and the immediate adoption of methods demonstrated to improve spray application. In the longer term this knowledge will undoubtedly have a positive economic impact on the industry.

9.3 Communication

Advertising flyers:

Flyers were used to advertise the workshop, based on a standard document sent to organizers, each region adapted for their workshop. Flyers were sent predominantly by email and in a few cases by post. Copies of flyers are attached (Appendix 5)

TV interviews:

WIN Television Riverland. Protection for Crops. Interview and story on WIN evening news 9/10/2008

Radio interviews:

Mildura, ABC Radio Mildura-Swan Hill Victoria 10/10/2008

Margaret River, ABC Radio South West WA rural report 23/10/2008

Industry journal articles: (Appendix 6)

Lindh, K (2008) US spray expert takes regional tour. *The Australian and New Zealand Grapegrower and Winemaker* **535**, 43-44.

Martin, L (2008) Avoiding bouncers and drifters. *Australian Viticulture* **12(6)**, 55-59.

DVD

A DVD has been produced from recording at the first workshop in the Adelaide Hills. A disc will be provided to GWRDC.

10 RECOMMENDATIONS

- Growers should read Andrews notes, look at the slides and consider the many recommendations for spray application contained in these notes.
- A national spring workshop series in vine health issues should be coordinated by the National Extension Steering Committee taking into account the following:
    - Regional organizers have requested a list of presentation options
    - Regional organizers be consulted on timing of presentations
    - A press package be prepared in advance
    - Clear guidelines as to timings be understood by presenters
    - Presenters need to be engaging and relevant to local issues/equipment
    - Notes be prepared in advance, printed and made available
    - Expectations of regional groups in providing venues, bbq's and communication need to be made clear.
    - The value add from presenters other experiences in the regions.
    - Online evaluation be tested and arranged beforehand
    - The role of commercial sponsors in adding to the success
    - The need to research and independent opinions to be unencumbered by commercial interests
    - The importance of commercial interests in contributing to vine health management
    - That full costs including time, airfares, BBQ's, communication, evaluation, organization and administration be accounted for and who is paying is publicly recognized.
- Develop a 1-2 day hands on training program, similar to that provided in New York State by Andrew Landers, for effective spray application with collaboration between the Centre for Spray Technology Application Research And Training, other Australian spray application experts and Andrew Landers.
- Measure and manage capacity in vine health. Increasing the capacity to manage vine health is an important outcome of the contribution of governments in cooperation with the wine industry. Industry leaders can encourage the measurement of an industry capacity to sustain production and protect assets by managing vine health through evaluating extension efforts and other intervention programs.

11 ACKNOWLEDGEMENTS

Thanks to GWRDC and Cornell University for their generous support in providing funds for Andrew Landers to undertake this travel and to SARDI and the NWGIC for their support through the time and efforts of Mark Sosnowski, Trevor Wicks and Duncan Farquhar in organizing and hosting Andrew Landers' visit. Many thanks also to each of the regional grower groups, for 'on-the-ground' organizing of workshops and providing venues, equipment and refreshments at each location. We also appreciate the efforts of Andrew Landers, for giving up his precious time to travel around Australia and deliver entertaining and informative workshops to the Australian wine industry.

Appendix 1. Workshop itinerary & local contact details

2008	Workshop location	Attendance	Contact name/email	Phone
Mon 29 Sept	Adelaide Hills, SA	42	Stefan Chandler SChandler@nepenthe.com.au	0401 711 438
Tue 30 Sept	Barossa Valley, SA	31	Ashley Ratcliff aratcliff@yalumba.com	0411 370 057
Thu 2 Oct	Wrattonbully, SA	42	Kerry DeGaris Kerry.DeGaris@stonehavenvineyards.com.au	0418 817 344
Fri 3 Oct	Mt Benson, SA	20	Nigel Squire nigel@frogisland.com.au	0439 686 178
Tue 7 Oct	McLaren Vale, SA	32	Amy Richards amy@mclarenvale.info	0414 787523
Wed 8 Oct	Clare, SA	32	Alison Phillips Alison.Phillips@leasingham-wines.com.au	0428 535 727
Thu 9 Oct	Loxton, SA	40	Tim Smythe tim.smythe@riverlandwine.org.au	0427 772 185
Fri 10 Oct	Mildura, Vic	43	Liz McGuire lmcguire@murrayvalleywinegrapes.com.au	03 5021 3911
Mon 13 Oct	Griffith, NSW	40	Kristy Bartrop kbartrop@wgmb.net.au	0422 717 573
Tue 14 Oct	Gundagai, NSW	38	Leo Quirk Leo.Quirk@dpi.nsw.gov.au	0411 128 452
Wed 15 Oct	Orange, NSW	35	Jeremy Bright Jeremy.Bright@dpi.nsw.gov.au	0427 213 059
Fri 17 Oct	Margaret River, WA	70	Diana Fisher dfisher@agric.wa.gov.au	08 9777 0000
Mon 20 Oct	Mount Barker, WA	50	Diana Fisher dfisher@agric.wa.gov.au	08 9777 0000
Wed 22 Oct	Yarra Valley, Vic	42	Kieren Murphy kieran.murphy@dpi.vic.gov.au	0409 568 705
Fri 24 Oct	Tamar Valley, Tas	28	Stuart Nettlefold Snettlefold@winetasmania.net.au	03 6223 3770
Mon 27 Oct	Hobart, Tas	27	Stuart Nettlefold Snettlefold@winetasmania.net.au	03 6223 3770

Appendix 2. DVD production & distribution

Production

Following the workshop series, GWRDC approved funding through a variation to project GWT 08/02 to facilitate the production and distribution of a DVD using footage recorded at the first workshop held in the Adelaide Hills at Lenswood Research Centre, SA.

Patrick Sproule (TV Production Lecturer, School of Visual and Performing Arts, Charles Sturt University CSU) was contracted to oversee post production editing. Alana Richards (CSU graduate student) was delegated the task as a project which formed part of her assessment. With editing by Mark Sosnowski and Duncan Farquhar, the footage was separated into chapters to cover the main sections presented by Andrew Landers. Mark Sosnowski visited Wagga Wagga and spent two days at CSU filming commentary in the vineyard and voice over in the studio to summarize each chapter. Mark and Duncan were able to review post production of chapters as they were made available via the internet through an ftp link, allowing for quick feedback and improvement.

Mark McKenzie (Wine Grape Growers' Australia) kindly accepted an invitation to provide an endorsement of the DVD, which was filmed at the Plant Research Centre on the Waite Campus and has been included as a prologue.

Media Movers (Alexandria NSW) was contracted to duplicate and print the DVD and has produced 500 copies, which were supplied in clear plastic sleeves.

In addition, Patrick Sproule has converted the video to Flash Video File (.flv) format suitable for use on wine industry websites.

In summary, the DVD production was a relatively smooth process. Utilizing the CSU School of Visual and Performing arts was cost effective compared with using a commercial service. The quality of the post production was excellent, considering the poor quality original footage taken with a handy cam without professional sound equipment. The time period for completion of the project was 6 months and would most likely have been considerably shorter with commercial production, although at a greater cost.

Distribution

A distribution plan has been proposed.

Initially copies of the DVD will be sent to leaders of each region. This will include a short questionnaire to get opinions from industry for further distribution and any requirement for additional information (eg. Andrew's report). Copies will then be distributed in batches to each regional leader to be further distributed to individuals.

Copies will also be available from:

NWGIC - contact Duncan Farquhar (duncan.farquhar@industry.nsw.gov.au; 02 6938 1644)

SARDI – contact Mark Sosnowski (mark.sosnowski@sa.gov.au; 08 83039489)

The DVD will also be made available in Flash Video File format on the NGWIC website.

Recommendations

- Future workshops should be recorded using professional visual and audio equipment to ensure the highest quality footage for post production
- The use of university or training institutions such as Charles Sturt University for post production keeps the cost to a minimum
- Breaking the video into chapters made the DVD more user friendly and accessible for growers and industry members

IMPROVING SPRAYING EFFICIENCY

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www.nysaes.cornell.edu/ent/faculty/landers/pestapp

1. Introduction

Methods of improving spray deposition and reducing drift during the application of pesticides has been of concern for many years. Pesticide drift, as defined by the National Coalition on Drift Minimization, is "the physical movement of pesticide through the air at the time of pesticide application or soon thereafter from the target site to any non-target site."

Spray drift is an important and costly problem facing growers. Drift results in damage to susceptible off target crops, environmental contamination to watercourses and an unintentionally reduced rate of application to the target crop, thus reducing the effectiveness of the pesticide. Pesticide drift also affects neighbouring properties, often leading to public outcry and conflict.

Traditional airblast sprayers direct the air from a single axial flow fan, mounted directly behind the sprayer, in an upward and outward direction, Figure 1. Axial fans are designed to move large volumes of air at low pressures, and an increase in fan diameter rather than fan speed is a more efficient way of increasing airflow rate. Traditional advice to growers was to use small adjustable deflector plates, fitted at the top and base of the air outlet to direct the air towards the target canopy in an attempt to confine it. Unfortunately many growers appear to be using sprayers with no deflectors or many manufacturers offer optional deflectors which serve little or no purpose.

The majority of growers use older, traditional design airblast sprayers fitted with hollow cone or air-shear nozzles that provide a large amount of air to penetrate the canopy and beyond, often resulting in a vast plume of spray drifting above the target row. Air-shear nozzles rely on high wind speeds (150-500 km/h) to create fine droplets, often exacerbating the drift problem, particularly when a sparse canopy exists in early season.

A series of workshops were held across Australia in October 2008, arranged by Drs Mark Sosnowski and Trevor Wicks of SARDI and Mr Duncan Farquar of The National Wine and Grape Industry Centre. Funding in part for this tour was kindly provided by the Grape and Wine Research and Development Corporation and Cornell University. This paper is provided as a supporting document for the workshop attendees.

Current spray practice is often to use the same settings on the canopy sprayer in the vineyard from the first application through to the last, irrespective of changes in canopy volume or density. Many growers may change application volume/hectare but certainly no changes are made to air flow (speed, volume or direction) nor forward speed. As the season progresses, as the canopy fills, growers frequently drive too fast and often pay too little attention to deposition on the leaves and grape clusters where disease or insects may occur and to drift. The objective in improving deposition is to find the optimum combination of application parameters for different stages of canopy development to improve deposition whilst reducing drift.

Two types of drift occur during or after pesticide application: vapour drift which is the airborne movement of evapourated chemical (highly volatile materials), can occur even after the droplet is deposited on a leaf surface. The second and more prominent, droplet drift, is the movement of spray droplets in liquid form. Smaller droplets, less than 100μm (microns) may be projected 33 feet or more vertically. For hydraulic nozzles found on air blast sprayers, 45% of droplets may be in the 30-100μm size range

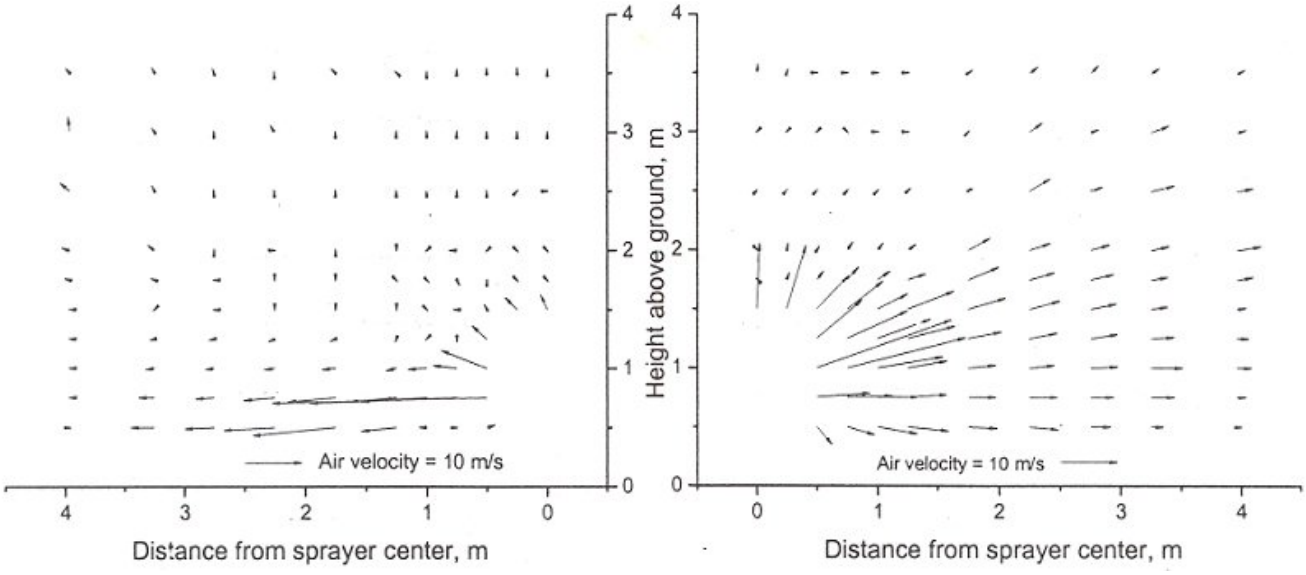


Figure 1 Air vector diagram showing air velocity and direction. Size of arrows indicate air speed

Droplets under 150 microns generally pose the greatest drift hazard; droplets less than 50 microns have insufficient momentum for impact as they remain suspended in the air indefinitely or until they evapourate. Research in England concluded that a 100 micron droplet takes 11 seconds approximately to fall three metres in still air; when a similar size droplet is released into a 8km/h wind it will drift about 23m before hitting the ground. Imagine the distance it could travel in a 290km/h airstream from some airshear sprayers! The higher the operating the pressure, the smaller the droplet, conversely, low pressure produces large droplets that may bounce off the target (droplets over 300 microns bounce). Deposition efficiencies are typically only 55% of the applied spray from an airblast sprayer, suggesting that 45% of pesticide either hits the ground contaminating the soil or goes up into the air. Much of the ground losses are spray droplets

returning to the ground from airborne drift. Depending on the canopy growth stage and season, losses occurring during spraying are:

Losses	*%*
Evapouration	4-6
Drift	10-15
Ground	30-50
On target	**29-56**

Table 1 Typical losses during spraying

Sprayer	**Application**	**Target**	**Weather**	**Operator**
Design	Application rate	Variety	Wind speed	Skill
Droplet size	Nozzle orientation	Canopy structure	Wind direction	Attitude
Fan size	Forward speed	Area	Temperature	
Air volume		Every row	Humidity	
Air velocity and direction		Alternate row		

Table 2. Inter-related factors affecting pesticide drift and deposition

2. Canopy

The vine canopy should intercept the spray plume as it passes outwards from the sprayer. The amount of droplet capture will depend on the volume, speed and direction of the spray cloud. The canopy also plays a major role during the first pre-bloom spray, in early season, when there is very little target area to capture the droplets and most of the spray passes through and is then subject to drift. Research was conducted at Cornell University using a LIPCO tunnel sprayer to measure spray retention in the canopy over the growing season. The LIPCO uses a recycling feature, any spray not captured in the canopy is recycled. The quantity being recycled was measured and in early season (May 22nd) shows that *var*. Cabernet Franc and Riesling canopies required only 170 litres/ha. In mid July the full canopy retained 500 litres /ha. Research is Spain, shows that early season losses to drift and ground deposition can be as high as 45%, depending on the volume applied, the variety and canopy development.

One of the major areas of concern is alternate row spraying in early season. Many growers have observed a large spray plume going past the target row, onto the second and third rows. As they are under pressure to improve their timeliness, they choose to spray alternate rows. When a disease outbreak occurs, questions are raised! Our research shows that sometimes the sprayer is calibrated for say 500 litres/ha, but growers frequently forget that it was calibrated for single row spacing at 2.8m. Driving alternate rows results in only 250 litres/ha per acre being applied,

frequently via a badly set-up sprayer, the result: disease outbreak. Results indicate very erratic deposition on the second row, particularly in early season canopies as the wind going across the vineyard can affect the spray plume, Figure 2 compares alternate row to every row application.

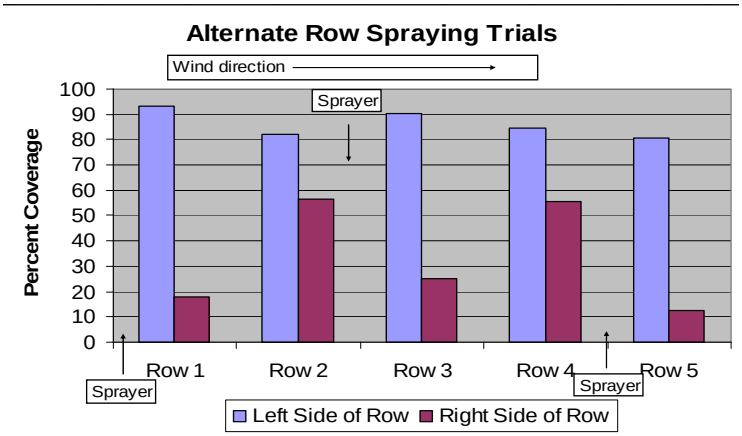


Figure 2 Erratic deposition in early season using alternate row spraying

3. Climatic conditions

The weather plays a critical role in drift management. Wind velocity, relative humidity, and temperature all affect the characteristics of the spray plume. As wind speeds increase, spray droplets will drift farther. Humidity and temperature determine how fast the spray will evaporate. A higher temperature means the droplets are more apt to dissipate and in some cases vaporize completely. At lower humidity, evaporation occurs much faster. Larger droplets, >200 microns, are affected the least due to their shorter travel times, but may still evaporate after depositing on the canopy. Atmospheric inversion is another problematic condition, when the temperature, instead of decreasing, rises with altitude. With cooler air at lower altitudes there is no tendency to form upward air currents, causing drifting pesticide droplets to become easily trapped. Spraying in ideal, neutral conditions greatly reduces the effects of drift.

Droplet size is important in determining the amount of drift in conjunction with the wind, temperature and relative humidity. The size of a droplet strongly influences its trajectory after being emitted from a hydraulic nozzle at a speeds of 70-110 km/h. Training the operator to recognize conditions which lead to excessive drift such as high winds, fine spray, inversion layers etc. is so important. Temperature affects spray droplet movement.

Unstable conditions – do not spray
Warm air is lighter than cold air so rises, an example of this is in the afternoon on a sunny day when the vineyards are warm, the air near the ground warms up and wants to rise up towards the cooler air above, this is referred to as an unstable surface layer. Air rises and mixes with the air above carrying pesticide particles with it.

Stable conditions – do not spray
At night the vineyard land gives up its heat rapidly (radiant cooling), the air nearest the vineyard is cold, and being heavier than the warm air above it remains close to the ground, this is referred to as a stable surface layer or temperature inversion. The cold air is unable to mix with the warm air above, causing small suspended droplets to form a concentrated cloud which can lead to long distance migration of pesticide drift, for several miles. Clear skies favour radiant cooling, and therefore favour inversion layers, this can occur in early morning and late afternoon.

Neutral conditions – spray
Cloudy skies, moderate to strong winds, i.e in excess of 4.5 km/h and bright sunshine are all conditions which don't favour inversions and are referred to as neutral conditions.

Sprayer operators can notice changes in the weather as the day progresses, often you can tell if an inversion layer is forming by watching smoke rise, if an inversion layer is present the smoke rises vertically for a short period and then turns, moving horizontally.

4. Barriers to drift

Buffer zones

In an ideal world, growers should avoid planting grapevines too close to neighbouring properties and water courses. A good, safe buffer zone should be between 15 to 45 metres, but the distance required will depend on the type of buffer zone, type of sprayer being used, toxicity of the pesticides, trellis design, and prevailing wind direction. Buffer zones are usually located on the downwind side of the vineyard.

German buffer zones are amongst the severest in Europe and are worthy of note. Since 1996 they have developed buffer zones and use a system described as the Drift potential index (DXI) to take into account local conditions such as water and vegetation. As far as grape vines are concerned they have measured drift values up 40 -50 metres.

Shelter belts

Augmenting the buffer zone with a natural or artificial shelterbelt is an effective means of further reducing drift, and also provides some visual-screening of vineyard operations. The primary purpose of a shelter belt or wind-break is to reduce wind flow across the vineyard, reducing drift from the vineyard and in some cases allowing the spraying operation to continue when it would be impossible on a more exposed site.

Windbreak height and porosity affect effectiveness, a porous buffer which slows air movement but does not redirect it up an over will remove more spray droplets than will a solid wall of vegetation. As a general guideline, this "scrubbed layer" extends to a distance of approximately 3 to 10 times the height of the barrier. The minimum height of the shelter belt should be at least double the release height of the pesticide e.g. a poorly directed air-blast sprayer shooting a spray plume 6 metres into the air will require a tree barrier of at least 15 metres high. Mixed plantings

of trees, with thin rough foliage and small hairy leaves are best for providing a porous barrier for collecting the spray.

5. Improving existing application techniques to improve dpeosition

1. *Weather monitoring equipment.*

Growers should purchase and use good quality instruments for measuring wind speed, temperature and humidity. Small, hand held anemometers cost around $100 and provide fairly accurate information on wind speed. Spraying with no wind present is dangerous due to potential problems with vapourisation and inversion layer conditions, similarly, spraying when wind conditions are too high is equally dangerous.

2. *Sprayer check*

One of the simplest ways to help reduce drift is to maintain and calibrate the sprayer, equipment should be maintained and operated according to manufacturer's instructions. A well trained operator will notice a spray plume drifting away as windspeed increases or changes direction. Choice of nozzle can affect drift by governing particle size, select low drift nozzles that minimize the number of drift prone fine droplets less than 150 microns. Replacing worn nozzles when they exceed the manufacturers flow rate by 10% and matching the correct nozzle to the type of application is a fairly inexpensive practice to help reduce drift.

Example of a 40 ha vineyard

$600/ha in pesticide costs
Sprayer with 10 nozzles in total
$600/10 = $60 / nozzle / ha
$60 x 40 ha = $2400 in pesticide cost per nozzle
Cost of an individual nozzle: $10 - 20

3. *Nozzle orientation*

Orientation of the nozzles affects the spray pattern being emitted from an air blast sprayer. Traditionally growers have positioned nozzles radially around the air outlet of the sprayer. The direction of the airstream, on a sprayer with a counter-clockwise rotating fan, carries the droplets upwards, over the canopy on the right-hand side of the sprayer, and predominately downwards on the left-hand side. Where the air flows the droplets will surely follow. At Cornell University an Italian vertical tray patternator (Mibo, Milano, Italy), is used to simulate the canopy at the center of the vine row. The patternator comprises a series of collecting trays which are situated at 16 inch intervals above the ground, the sprayer is turned on and the water plume collects in the trays. Water then runs down pipes into a row of measuring cylinders, indicating the spray profile or vertical distribution pattern. Different nozzle configurations (number and orientation) are selected and vertical spray patterns determined.

Results from the patternator, figures 3 and 4, shows not only the great variability in spray pattern produced according to nozzle orientation but also the lack of symmetry between each side of the sprayer. Note 33% of the spray was overshooting the canopy before a change in nozzle orientation was made. On the Berthoud S600EX sprayer used as an example, nozzles set

in the “typical growers” pattern, Figure 3, pointing radially outwards, resulting in a large quantity of spray being blown above the target row. The best spray pattern for the grape zone, Figure 4, occurred when the right hand side nozzles were pointing horizontally and the top two nozzles were 20^{o} below horizontal on the right side, to counteract the upward movement of the air from the fan. Best results occurred with the left side nozzles pointing 45^{o} upwards to counteract the downward direction of the air from the fan. The results show the importance of correct nozzle orientation if pesticides are to be applied effectively onto the target.

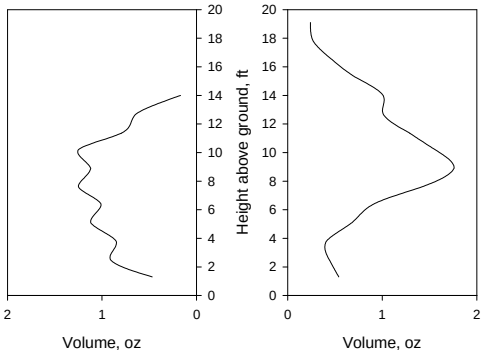


Figure 3. Original nozzle setting

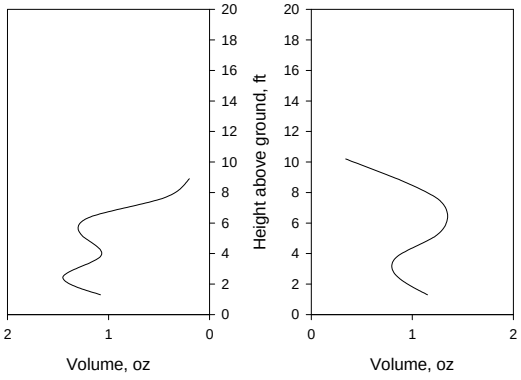


Figure 4. Improved nozzle setting

NOTE: Results shown are for a Berthoud S600EX sprayer, individual sprayer models will vary.

An inexpensive and simple patternator may be constructed on the farm using fly screens, similar to those found on windows. A detailed build list and photographs maybe found on my web page at http://www.nysaes.cornell.edu/ent/faculty/landers/pdf/Patternator.pdf

To see where the spray is actually going in the vineyard, a grower can create a simple system to check the spray plume. One method is to use a 5m high, 25 mm wide wooden pole with paper tape (commonly found in cash registers or office calculators) stapled along the leading edge. Place the pole between two vines within the row, attach it to the trellis wire using plastic ties and spray a mixture of clean water and food colouring. Travel between the rows, spraying out the mixture. The spray will stain the paper where it hits. By looking at the coloured spray droplets on the paper, the grower can alter the orientation of the nozzles, fans or deflectors until the spray cloud is only hitting the portion of the vertical pole/vines that is desirable. Double check the spray output with a new piece of paper tape following each alteration of the operating parameters.

4. *Air Induction Nozzles (AI).* These nozzles, when used properly, can reduce drift by at least 50 percent. The principle behind these nozzles is to create a larger droplet that won’t drift as far but still maintain good leaf and fruit coverage. Air induction (A.I) nozzles are available either as flat fan or hollow cone nozzles where an internal venturi creates negative pressure inside the nozzle body. Air is drawn into the nozzle through one or two holes in the nozzle side, mixing with the spray liquid. Figure 5 shows the results of a drift comparison trial at Cornell University, where a Berthoud trailed airblast sprayer was fitted with flat fan air induction nozzles and compared to the same sprayer fitted with hollow cone nozzles.

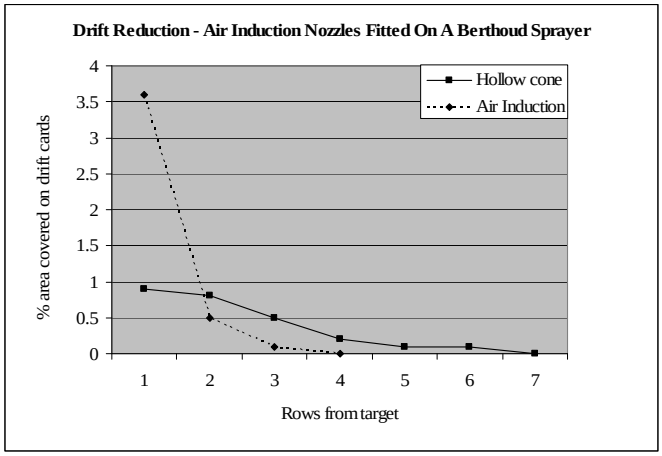


Figure 5. Drift reduction using air induction nozzles

5. Regulating air speed.

PTO speed

Regulating the PTO speed of the tractor is an inexpensive way to reduce drift. Traditional airblast sprayers direct the air from a single, axial flow fan, mounted directly behind the sprayer in an upward and outward direction. Where the air goes, the droplets will surely follow. Early – mid season sprays are frequently applied at full fan speed, resulting in a mighty plume of pesticide going towards a small leaf target on a small vine or up into the air above the vineyard. Is it necessary to have the fan rotating at all or even rotating at very slow speed? Do we really need to use an airblast sprayer creating up to 50,000 cubic metres of air/hour at airspeeds of up to 300 km/h when our leaf target is only a few millimetres long in early season?

In trials at Cornell University**,** Table 3, with an airshear type sprayer (AgTec), drift was detected on water sensitive cards fitted to 4m tall drift poles, placed at 6m intervals up to 24m from the target row. When the tractor PTO speed was reduced by 25%, drift was reduced by 75%. The reduced air speed also increased droplet size (due to the operating characteristics of air shear nozzles), further reducing the effects of drift. Reducing PTO speed with a conventional airblast sprayer will have a similar effect.

Hydraulic Drive

Using a hydraulic motor to drive the sprayer fan will allow the operator to regulate wind velocity. A hydraulic control valve can be fitted in the tractor cab to allow the operator to infinitely vary the fan input speed from 0 rpm up to 540 rpm. The operator can reduce air speed during early to mid season applications and increase it for full canopy applications. When approaching the end of a block of vines, near neighbouring properties, drift-sensitive crops, roads or water courses the operator can easily adjust the airflow and therefore reduce the spray plume. Care should be taken to ensure the tractor has a high enough oil flow (gallons/minute) to drive the hydraulic motor at speed.

Tractor[1] PTO Speed, rpm	Sprayer Fan Speed, rpm	Drift pole 1	Drift pole2	Drift pole 3	Drift pole 4
		Spray Coverage, %			
540[2]	2076	75.90	69.00	16.60	10.10
405[3]	1557	16.70	0.20	0.10	0.04

Key:

Each drift pole is located 6m from the target row

1 John Deere 5520 tractor

2 Mean wind was 5.5 mph coming from NW with gusts of 10.5 mph

3 Mean wind was 7.7 mph coming from NW with gusts of 12.5 mph

Table 3. The effect of fan speed on spray drift from an Ag Tec sprayer

Cornell Doughnuts

These attachments restrict air intake and therefore reduce air flow through the airblast sprayer. A simple plywood doughnut can be constructed using a jig saw and attached to the sprayer air intake using bolts. The diameter of the intake is measured and a hole created in the centre of the plywood circle. Remember to ensure a safety grill is fitted to prevent fingers from entering the fan. For early season, a 1/2 diameter air intake doughnut can be used, allowing just enough air to penetrate just the target row. A 2/3rd air intake hole can be used for early/mid-season to allow more air to flow. Finally in a full canopy, no doughnut is required. Results of trials indicate excellent drift reduction from a simple yet effective device.

6. Directing airflow

Tower sprayers, deflectors and multi-fan sprayers

Tower sprayers and deflectors are better at reducing drift and targeting the spray into the canopy than a conventional airblast. The conventional air blast sprayer sends droplets in an air blast from a central fan upwards and outwards into the canopy whereas the addition of a tower or deflectors creates a horizontal air curtain. In some cases the horizontal airflow can be adjusted via internal deflectors to direct the air e.g. towards the fruiting zone. A number of manufacturers sell “grape towers” as a retrofit to existing airblast sprayers

Directed air ducts

A number of sprayers direct the air to the target via adjustable outlets mounted around the canopy, e.g Silvan and Hardi SPV. Each outlet incorporates a hydraulic or air shear nozzle surrounded in a stream of air. The outlets may be mounted on either side of the sprayer or fitted to a frame or gantry allowing two to three rows to be sprayed. Outlet angle is adjustable, depending upon growth stage, shape and density of the canopy. The converging air stream

provides good leaf turbulence resulting in excellent penetration with minimum drift. Growers are encouraged to alter the angle of the air outlets, e.g. in early season use the lower outlets only for spray and place the upper units in a horizontal plane to create an air blanket over the row, thus keeping the droplets within the canopy.

Tangential blowers

A few sprayers are available which use a hydraulically driven tangential or cross flow fan to blow air radially into the canopy. A line of hydraulic nozzles or spinning discs produce droplets which are then carried by the airstream. The position of the fans is adjustable, allowing a more directed spray plume than from a traditional airblast sprayer.

Multi-head fans

These sprayers, such as , Croplands Quantum Mist and Greentech use small axial fans to create a directed airblast, either driven by hydraulic or electric motors, in front of each small fan are hydraulic nozzles. Hydraulic nozzle versions allow operators to change droplet size by changing nozzle size or system pressure. The fans should be adjusted so that they are not directly opposite each other (remember cymbals clash and air will move upwards and downwards) so adjustments should be made so that the fans are facing at least 5-10degrees backwards. In early season check the effect of only two diagonally opposed fans in operation, rather than using all four fans. Manufacturers are encouraged to fit fan speed controllers in the tractor cab to allow operators to adjust fan speed as conditions vary.

7. Axial fan size, speed and air induction nozzles

Using an axial fan producing 20,000m^3/hr and in conjunction with air induction nozzles will result in a 75 percent reduction of drift. In order to accommodate varying crop canopies, e.g as the season progresses, a number of modern sprayers are fitted with adjustable pitch propellers to provide a variable airflow. Operators can manually adjust blade pitch either by turning a handle or altering individual blades. Growers should assess air volume requirements by observing spray penetration into the canopy and the amount of spray going up and over or through the canopy.

8. Foliage Sensors

These sensors, either operating with infra red or ultra-sonics detect the absence or presence of a vine or canopy. Each sensor fires a ray of light or sound towards the canopy, any resulting reflection, due to the presence of vines or canopy, is picked up by the sensor and automatically opens or closes a valve near the nozzle(s) allowing spray to be emitted or switched off. The use of sensors reduces overspray of the canopy and can reduce drift by 50 percent, they also cut down on the amount of pesticide being used. They are relatively expensive in the USA (not so in Europe!).

9. Tunnel Sprayers

The LIPCO tunnel sprayer comprises a plastic tunnel mounted onto a frame, the tunnel surrounds the grapevine. Mounted on the inside the tunnel walls are two vertical spray-booms fitted with hollow cone or flat fan nozzles which direct spray horizontally, into the grape canopy. Any excess spray is runs down the inside of the tunnel wall and is collected in a trough at the base of the tunnel where it is recycled back to the main tank. In early season trials, up to 75% of spray

was recycled, at full canopy very little recycling occurs but average reduction in pesticide use amounts to 35% over the season. Research conducted at The Federal Biological Research Centre for Agriculture and Forestry (BBA) at Braunschweig, Germany, shows that the tunnel sprayer reduces drift by 90% and, when air induction nozzles are fitted, reduces drift by 99%. Tunnel sprayers were developed as long as 50 years ago are becoming very popular and will continue to do so. Modern construction using lightweight plastic or glass-fibre and well-designed hitches allows a fair degree of maneuverability. Their major success is in reducing the visual effect when compared to the large plume created by other sprayers, helping reduce public perception of pesticide application.

10. Drift reducing additives

A number of manufacturers supply drift reducing agents, most work via increasing droplet size (larger droplets don't drift). Beware not all of them can withstand the higher pressures associated with fruit sprayers and interestingly often create more drift than without agents. Growers should seek independent verification of the effectiveness of drift reducing additives, rather than accept the advice from the company sales person!

11. Nozzle selection

Remember that large droplets, over 300 microns bounce and small droplets, less than 150 microns are drift-prone. Remember the effect on droplet size of using old and or damaged nozzles. Clear blocked nozzle tips using compressed air or an old toothbrush. NEVER kiss nozzles.
As a guide, select nozzles based upon the selected target, using spray quality charts found in modern nozzle catalogues.
Target: Insects/ disease on foliage, contact sprays: FINE spray quality
Target: Foliage, herbicides and systemic products :MEDIUM spray quality
Target: Soil, pre-emergent hebicides: COARSE spray quality

12. Monitoring the effectiveness of the sprayer in the vineyard.

Check to see the effect of changes you have made to your application methods. Use Kaolin clay products such as "Surround" to see deposition in daylight, it is safe and inexpensive. An alternative is to use fluorescent tracers but double check that they are "food safe" and approved for such use; use them at night. Remember the boundary layer effect of airflow on a body so look at many samples, particularly in the fruit zone.

An alternative to purchasing expensive water sensitive cards is to use food colouring and photographic quality paper cut into 25mm x 50mm strips, stapled over the leaves.

13. Calibration

Remember to calibrate the sprayer, check individual nozzle output and replace nozzles whose output exceeds 10% of the catalogue value. A particularly good calibration method is described on You Tube via the internet:-

Calibration of airblast sprayers for vineyards - Part 1 Selecting and changing nozzles
Calibration of airblast sprayers for vineyards -Part 2 Measuring nozzle flow

Conclusions

Drift is impossible to eliminate but can be minimized. Implementing some of the above methods will improve the efficiency of the spray application saving time, money, and future problems.

1. Good operator training on the causes of drift, recognizing when weather conditions change and how to take avoiding action will help.
2. Good machinery and operator management, as always, will improve deposition and reduce drift problems.
3. Changing nozzle orientation to match canopy development will pay dividends.
4. Build a patternator to see where the spray is going.
5. Use tracers to monitor deposition within the canopy following changes in sprayer operating parameters.

Cornell University

Application Technology Group
NYSAES, Geneva, NY

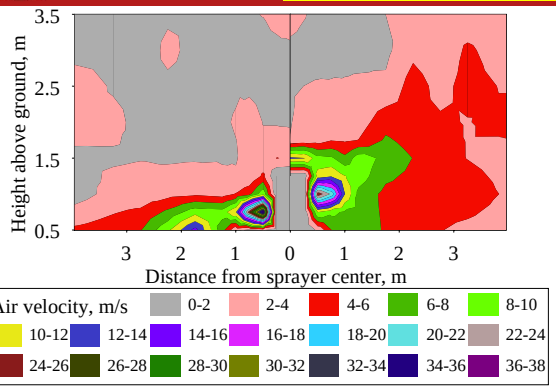
EFFECTIVE APPLICATION

Andrew Landers
Cornell University
Dept. of Biological & Environmental Engineering, Ithaca
Dept. of Entomology, Geneva
New York, USA

www.nysaes.cornell.edu/ent/faculty/landers/pestapp

Cornell University

Air Velocity Pattern



Cornell University

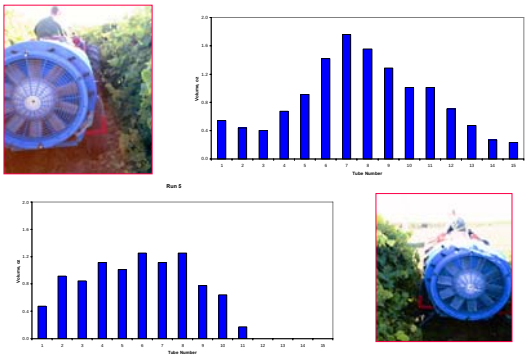
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AIR

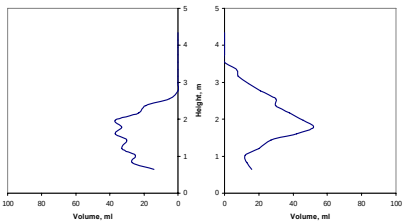
- Transports droplets from the sprayer to the target
- Protects droplets against wind effects
- Droplet production (pneumatic sprayers)
- Provides shaking of the leaves in the canopy

- Transports droplets through & past the target
- Excessive shaking of the canopy
- Remove droplets already present on the target

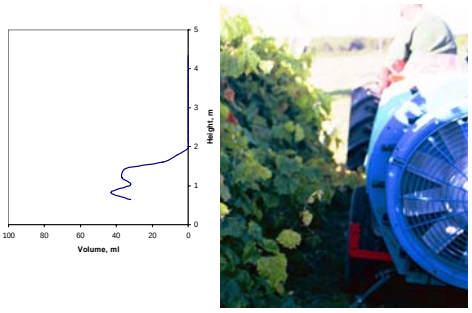
Typical Growers Setting



Typical Growers Setting

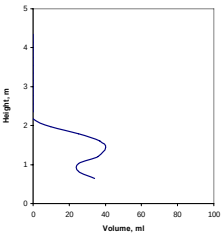


Improved setting for the fruit zone



Improved setting for the fruit zone











Air grate



No air grate





Air grate fitted



Patternator for growers to build







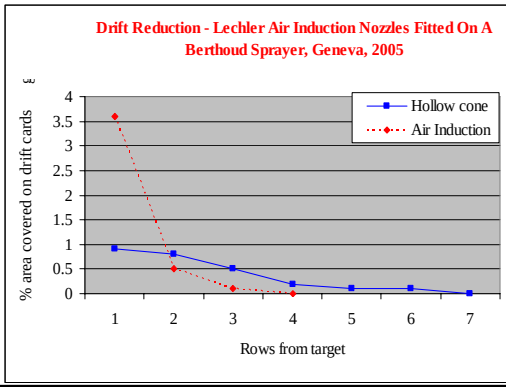
http://www.nysaes.cornell.edu/ent/faculty/landers/

Dalrymple patternator

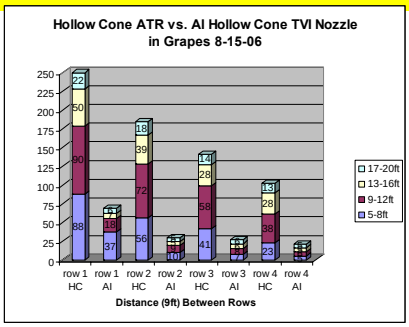




OMAFRA, Ontario, Canada - telescopic

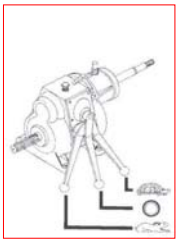


Drift Reduction - Albuz Air Induction Nozzles Fitted On A Berthoud Sprayer, Geneva, 2006



What can be done to adjust airflow?

- Reduce fan speed via gearbox, use low gear





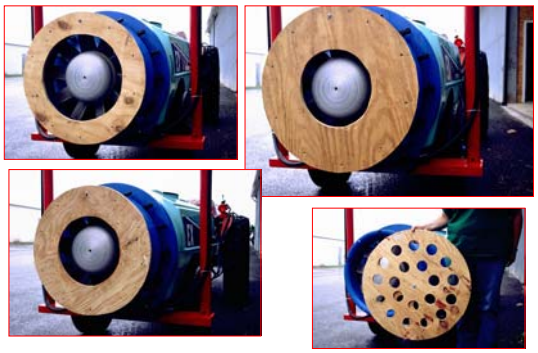


What can be done to reduce airflow?

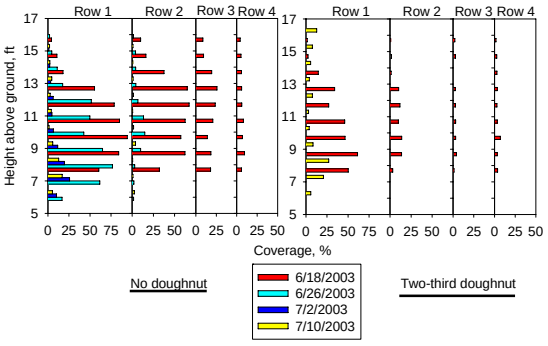
- Reduce fan speed via gearbox, use low gear
- Change blade pitch to adjust air flow



Cornell Doughnuts



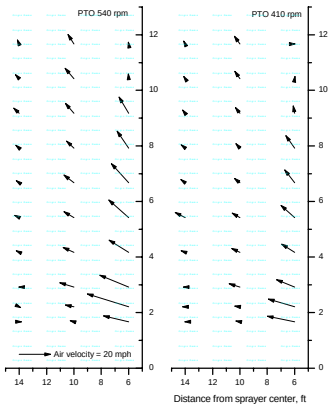
Drift and Canopy Growth Stage



What can be done to reduce airflow?

- Reduce fan speed via gearbox, use low gear
- Fit a control baffle to the fan intake
  - "Cornell doughnut"
- Reduce pto speed (beware of loss of torque)

540 PTO speed



410 PTO speed

Air velocity vectors on left side of sprayer

The effect of fan speed on spray drift from AgTec Sprayer 2004

Tractor[1] engine speed, rpm	Tractor PTO speed, rpm	Sprayer fan speed, rpm	Pole 1	Pole 2	Pole 3	Pole 4
			Spray coverage, %			
1650[2]	540	2076	75.9	69.00	16.60	10.10
1250[3]	405	1557	16.70	0.20	0.10	0.04
			Cards covered over 50 % (Total cards = 8)			
1650	540	2076	6	8	0	0
1250	405	1557	0	0	0	0

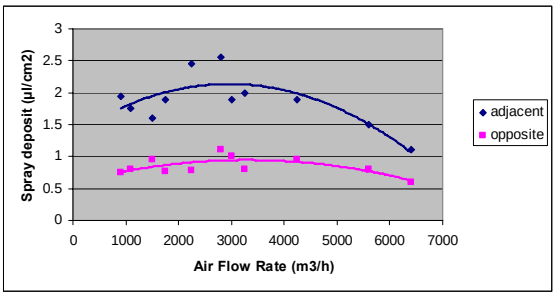
1 John Deere 5520 tractor
2 Mean wind was 5.4 mph coming from NW with gusts of 10.5 mph
3 Mean wind was 7.7 mph coming from NW with gusts of 12.4 mph

Cornell University

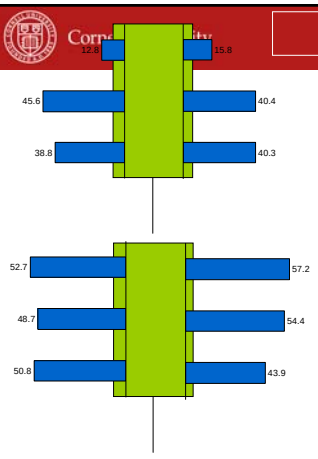
Hydraulic motor to drive fan along with a flow control valve



Spray deposits obtained on the vine row as a function of the air velocity adopted



P Balsari, P Marucco, and M Tamagnone, 2007, Technik im Weinbau







Cornell University

Application Technology Group
NYSAES, Geneva, NY





Directed deposition























Advantages and Disadvantages of Tunnel Sprayers

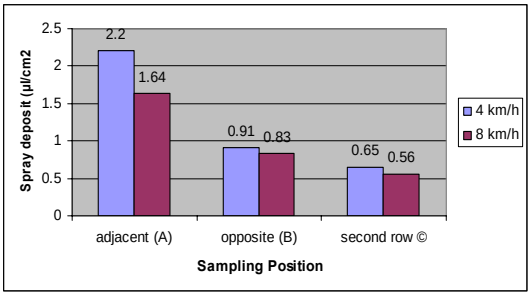
Advantages:

- reduction in drift (90%)
- reduced amount of pesticides used/acre, particularly during early applications (30% av.)

Disadvantages:

- Cost ?
- difficulty in turning on short headlands

Average spray deposits on leaves assessed in different parts of the rows as a function of the forward speed adopted



P Balsari, P Marucco, and M Tamagnone, 2007, Technik im Weinbau,

Ultra sonic sensors

Sends out a sonic beam, if a tree is present, the wave bounces back, so the electric valve opens up the corresponding valves/nozzles.

If tree is absent, valves/nozzles remain closed





Manual versus sensor operation all trees

- % reduction in spray varies between 2-19% in modern apple plantings in our 2007 trial with 5 of the 10 growers participating. Depends so much on :-
- Tree size, spacing, gaps in the leaf wall,
- Time of the season

Botrytis sprayer







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NYSAES, Geneva, NY





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Calibration



You Tube

Calibrating airblast sprayers -vineyards



Improving Spray Application in the Vineyard | NSW Department of Primary Industries - Microsoft Internet Explorer provided by NS

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Address http://www.dpi.nsw.gov.au/agriculture/horticulture/grapes/spray2/spray Go

Improving Spray Application in the Vineyard

Workshop survey

- Download a copy of Andrew's presentation from the NWGIC website (www.csu.edu.au)
- Complete the online workshop survey

Background information

In October this year Dr Andrew Landers from Cornell presented a workshop about spray application in vineyards. This survey is designed to see how this workshop has been useful for grape producers. Results will be made available.

By completing the survey you are entered into a draw to win one of two hand help anemometer. Two companies have donated a hand held anemometer as incentives to provide feedback. www.weatherdownunder.net.au/wind have donated a windmate 200 and www.instrumentchoice.com.au have donated a Kestrel 1000.

Thank you also to these companies for providing a discount to grapegrowers who mention this survey. The anemometers will be awarded to the 20th and 50th person who completes the survey. You need not have attended to complete the survey and enter the draw.

If you have any photographs of modifications or inventions you have made please email Duncan.Farquhar@csu.edu.au.



Workshop held at NSW DPI Griffith Centre for Irrigated Agriculture on Monday 13th October.

Andrew's visit to Australia was made possible with a GWRDC funded travel grant to fund travel and accommodation, with the leadership of Mark Sosnowski from the South Australian Research and Development Institute, members of the National Extension Steering committee and through the on ground efforts of the regional extension officers and industry association leaders who arranged each of these events. Thanks again to the drivers of the sprayers, the venues, organisers of projection gear, catering staff, the vineyard owners, to those who arranged the Kaolin and the other requirements.

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Local intranet

NWGIC - National Wine and Grape Industry Centre - Charles Sturt University - Microsoft Internet Explorer provided by NS...
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Improving Spray Application in the Vineyard

Workshop Survey

Complete the on-line workshop survey



Two companies have donated a hand held anemometer as incentives to provide feedback. www.weatherdownunder.net.au/wind have donated a windmate 200 and www.instrumentchoice.com.au have donated a Kestrel 1000.

Thank you also to these companies for providing a discount to grapegrowers who mention this survey. The anemometers will be awarded to the 20th and 50th person who completes the survey.

Also Australian Grapegrower and Winemaker have donated a years subscription to be drawn from people who provide feedback.

Workshop Information

Please find copies of the Dr Andrew Landers presentations:

The grand tour 2008 presentation handout

Improving spraying efficiency the grand tour 2008



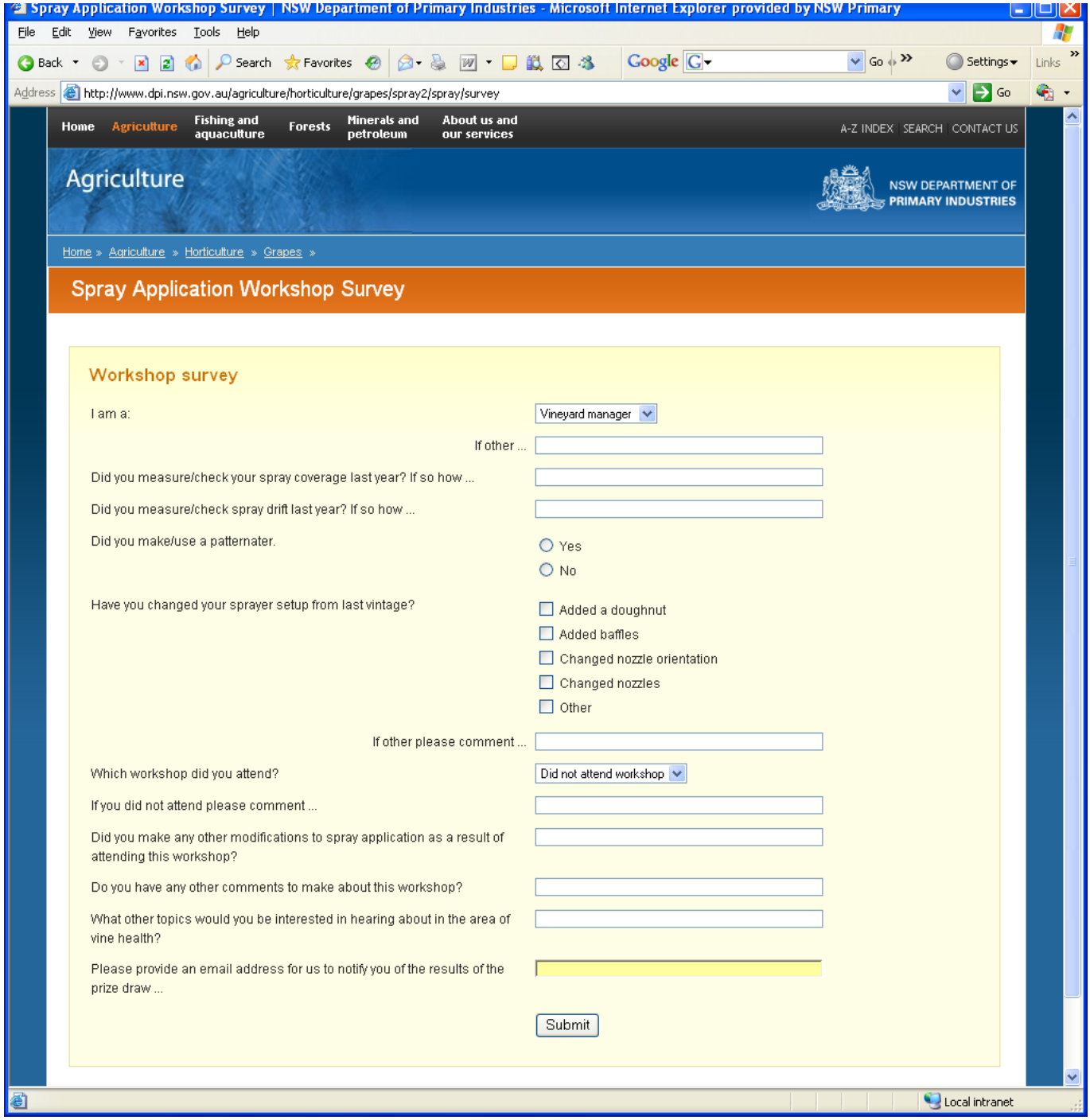


Thanks also to Associate Professor John Kent who gave this additional presentation at the Griffith workshop. Below is a copy of A/Prof Kent's presentation:

Spray Volumes, Distance Calibration and Concentration Factors

Dr Andrew Landers Background Information

Done Internet


Spray Application Workshop Survey | NSW Department of Primary Industries - Microsoft Internet Explorer provided by NSW Primary
File Edit View Favorites Tools Help
Back Search Favorites Google Go Settings Links
Address http://www.dpi.nsw.gov.au/agriculture/horticulture/grapes/spray2/spray/survey
Home Agriculture Fishing and aquaculture Forests Minerals and petroleum About us and our services
A-Z INDEX SEARCH CONTACT US
Agriculture
NSW DEPARTMENT OF PRIMARY INDUSTRIES
Home » Agriculture » Horticulture » Grapes »
Spray Application Workshop Survey
Workshop survey
I am a:
Vineyard manager
If other ...
Did you measure/check your spray coverage last year? If so how ...
Did you measure/check spray drift last year? If so how ...
Did you make/use a patternater.
Yes
No
Have you changed your sprayer setup from last vintage?
Added a doughnut
Added baffles
Changed nozzle orientation
Changed nozzles
Other
If other please comment ...
Which workshop did you attend?
Did not attend workshop
If you did not attend please comment ...
Did you make any other modifications to spray application as a result of attending this workshop?
Do you have any other comments to make about this workshop?
What other topics would you be interested in hearing about in the area of vine health?
Please provide an email address for us to notify you of the results of the prize draw ...
Submit
Local intranet

Adelaide Hills Wine Region

GWRDC & SARDI

WORKSHOP

Improving Spray Application in the Vineyard

Dr Andrew Landers
Cornell University NY USA

Seminar (1 hour)

- How droplets are formed and how we can make better use of them
- The answer is blowing in the wind - how airflow affects penetration and deposition - how we can adjust airfllow to improve deposition
- Reducing drift - inexpensive ways of getting the spray onto the target - modifications from $0 to $24,000
- Developments in vineyard spraying in Europe and North America

Field demonstration (1.5 hours)

- Practical ways to improve deposition and reduce drift - simple modifications to the sprayer
- How can we tell where the spray is going? - effective tracer techniques

BIOGRAPHY

Dr Landers studied and taught agricultural engineering in England. He obtained his masters degree at Cranfield University and his PhD at the University of Bath. His thesis work involved the development of a direct injection crop sprayer, leading to variable rate application in precision farming. He taught agricultural students at the Royal Agricultural College before becoming head of the engineering department at Harper Adams University. He joined the faculty at Cornell University in 1998, and is currently based at the New York State Agricultural Experiment Station in Geneva. He directs the application technology program and his teaching/extension/research appointment involves the use of engineering solutions to provide safer spraying. His group works with application systems in grapes, apples, vegetables and turf grass and he believes in a multi-disciplinary approach to pesticide application, working with biologists to ensure engineering techniques are biologically effective. Dr. Landers is author of the classic textbook, *Farm Machinery: Selection, investment and management*.

Date: Monday September 29th.
Venue: Lenswood Research Centre
Time: 10.00 a.m.
RSVP: Stefan Chandler, by Thursday September 25th.
Email - schandler@nepenthe.com.au
Mobile 0401 711 438

WORKSHOP

Improving Spray Application in the Vineyard

Dr Andrew Landers, Cornell University NY USA

Dr Landers studied and taught agricultural engineering in England. He obtained his masters degree at Cranfield University and his PhD at the University of Bath. His thesis work involved the development of a direct injection crop sprayer, leading to variable rate application in precision farming. He taught agricultural students at the Royal Agricultural College before becoming head of the engineering department at Harper Adams University. He joined the faculty at Cornell University in 1998, and is currently based at the New York State Agricultural Experiment Station in Geneva. He directs the application technology program and his teaching/extension/research appointment involves the use of engineering solutions to provide safer spraying. His group works with application systems in grapes, apples, vegetables and turf grass and he believes in a multi-disciplinary approach to pesticide application, working with biologists to ensure engineering techniques are biologically effective. Dr. Landers is author of the classic text book, Farm Machinery: Selection, investment and management.

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Field demonstration (1.5h)

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- How can we tell where the spray is going? - effective tracer techniques

Date: Thursday October 2

Venue location: Stonehaven Wrattonbully Elderslie Road Vineyard

Time: 9.30am

For bookings, please contact: Heather Whitehead 87 620280

Cost: $10 (Includes lunch and proceedings)

Mount Benson Vignerons Association & PIRSA

LOCAL AREA EUTYPA SURVEY RESULTS & IMPROVING SPRAY APPLICATION WORKSHOP

DATE:- Friday 3rd OCTOBER 2008
VENUE:- Norfolk Rise Vineyard, Limestone Coast Rd
TIME:- 9.15am till 1.45pm
COST:- MBVA members free, non members $20

RSVP:- **Friday 26th September**, Nigel Squire 0439 686 178
nigel@frogisland.com.au

PROGRAM:-

9.30 – 10.00	Eutypa survey results and discussion.	Adrian Loschiavo PIRSA
10.00 – 11.00	Spray Application Seminar	Dr Andrew Landers Cornell Uni
11.15 – 12.45	Spray Application Field Demo	Dr Andrew Landers Cornell Uni
12.45 – 1.45	BBQ Lunch and discussion	

Dr Andrew Landers, Cornell University NY USA

Dr Landers studied and taught agricultural engineering in England. He obtained his masters degree at Cranfield University and his PhD at the University of Bath. His thesis work involved the development of a direct injection crop sprayer, leading to variable rate application in precision farming. He taught agricultural students at the Royal Agricultural College before becoming head of the engineering department at Harper Adams University. He joined the faculty at Cornell University in 1998, and is currently based at the New York State Agricultural Experiment Station in Geneva. He directs the application technology program and his teaching/extension/research appointment involves the use of engineering solutions to provide safer spraying. His group works with application systems in grapes, apples, vegetables and turf grass and he believes in a multi-disciplinary approach to pesticide application, working with biologists to ensure engineering techniques are biologically effective. Dr. Landers is author of the classic text book, Farm Machinery: Selection, investment and management.

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- How can we tell where the spray is going? - effective tracer techniques

Improving Spray Application in the Vineyard

Tuesday 7th October 2008
9:30 – 12:30am
McLaren Vale Visitor Centre

Cost covered by WIF

Dr Andrew Landers, Cornell University NY, USA

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- Practical ways to improve deposition and reduce drift - simple modifications to the sprayer
- How can we tell where the spray is going? - effective tracer techniques

McLaren Vale Grape Wine & Tourism Industry Association, PO Box 169, McLaren Vale SA 5171
T (08) 8323 8999 F (08) 8323 9332 W: www.mclarenvale.info Email info@mclarenvale.info

Numbers are limited, so register quickly
For further information call 8323 8999 or email Janice to notify of your attendance
Janice@mclarenvale.info

Registration information

Name:

Company:

Phone: Fax: email:

Clare Region Winegrape Growers Association

WORKSHOP

Improving Spray Application in the Vineyard

Dr Andrew Landers, Cornell University NY USA

Dr Landers studied and taught agricultural engineering in England. He obtained his masters degree at Cranfield University and his PhD at the University of Bath. His thesis work involved the development of a direct injection crop sprayer, leading to variable rate application in precision farming. He taught agricultural students at the Royal Agricultural College before becoming head of the engineering department at Harper Adams University. He joined the faculty at Cornell University in 1998, and is currently based at the New York State Agricultural Experiment Station in Geneva. He directs the application technology program and his teaching/extension/research appointment involves the use of engineering solutions to provide safer spraying. His group works with application systems in grapes, apples, vegetables and turf grass and he believes in a multi-disciplinary approach to pesticide application, working with biologists to ensure engineering techniques are biologically effective. Dr. Landers is author of the classic text book, Farm Machinery: Selection, investment and management.

Seminar (1h)

- How droplets are formed and how we can make better use of them
- The answer is blowing in the wind - how airflow affects penetration and deposition - how we can adjust airfllow to improve deposition
- Reducing drift - inexpensive ways of getting the spray onto the target - modifications from $0 to $24,000
- Developments in vineyard spraying in Europe and North America

Field demonstration (1.5h)

- Practical ways to improve deposition and reduce drift - simple modifications to the sprayer
- How can we tell where the spray is going? - effective tracer techniques

Date: **Wednesday October 8, 2008**

Venue location: **Annie's Lane Vineyard, Watervale**

Time: **9:30- 12- Followed by BBQ Lunch**

For bookings, please contact: Alison Phillips- 0428535727

The Riverland Viticulture Technical Group in conjunction with SARDI would like to invite you to the following workshop to be held on Thursday the 9th of October 2008:

Improving Spray Application in the Vineyard

With special guest presenter:

Dr Andrew Landers, Cornell University NY USA

Dr Landers studied and taught agricultural engineering in England. He obtained his masters degree at Cranfield University and his PhD at the University of Bath. His thesis work involved the development of a direct injection crop sprayer, leading to variable rate application in precision farming. He taught agricultural students at the Royal Agricultural College before becoming head of the engineering department at Harper Adams University.

He joined the faculty at Cornell University in 1998, and is currently based at the New York State Agricultural Experiment Station in Geneva. He directs the application technology program and his teaching/extension/research appointment involves the use of engineering solutions to provide safer spraying. His group works with application systems in grapes, apples, vegetables and turf grass and he believes in a multi-disciplinary approach to pesticide application, working with biologists to ensure engineering techniques are biologically effective. Dr Landers is author of the classic text book; 'Farm Machinery: Selection, investment and management.'

Seminar (9am – 10am)

- How droplets are formed and how we can make better use of them.
- 'The answer is blowing in the wind' - how airflow affects penetration and deposition - how we can adjust airflow to improve deposition.
- Reducing drift - inexpensive ways of getting the spray onto the target - modifications from $0 to $24,000.
- Developments in vineyard spraying in Europe and North America.

Field demonstration (10.30am – 12pm)

- Practical ways to improve deposition and reduce drift - simple modifications to the sprayer.
- How can we tell where the spray is going? - effective tracer techniques.

Loxton Research Centre and SARDI staff members; Geoff Furness and Peter Magarey will also be available to answer your questions.

Thursday 9th of October

Registrations from 8.45am

Loxton Research Centre – Farm Office

Please book your attendance (no charge):

Tim Smythe at the RWIDC on (08) 8582 2952 or tim.smythe@riverlandwine.org.au

Please note that places are limited.

Morning tea and lunch will be provided.

GROWER WORKSHOP

Improving Spray Application in the Vineyard

Dr Andrew Landers, Cornell University NY USA

Dr Landers studied and taught agricultural engineering in England. He obtained his masters degree at Cranfield University and his PhD at the University of Bath. His thesis work involved the development of a direct injection crop sprayer, leading to variable rate application in precision farming. He taught agricultural students at the Royal Agricultural College before becoming head of the engineering department at Harper Adams University. He joined the faculty at Cornell University in 1998, and is currently based at the New York State Agricultural Experiment Station in Geneva. He directs the application technology program and his teaching/extension/research appointment involves the use of engineering solutions to provide safer spraying. His group works with application systems in grapes, apples, vegetables and turf grass and he believes in a multi-disciplinary approach to pesticide application, working with biologists to ensure engineering techniques are biologically effective. Dr. Landers is author of the classic text book, Farm Machinery: Selection, investment and management.

Seminar



- How droplets are formed and how we can make better use of them
- The answer is blowing in the wind - how airflow affects penetration and deposition - how we can adjust airfllow to improve deposition
- Reducing drift - inexpensive ways of getting the spray onto the target - modifications from $0 to $24,000
- Developments in vineyard spraying in Europe and North America

Field demonstration



- Practical ways to improve deposition and reduce drift - simple modifications to the sprayer
- How can we tell where the spray is going? - effective tracer techniques

Concentration and calibration

- Concentration factors
- Distance calibration for your vineyard
- Volume distribution in relation to canopy size

Date:	13th October 2008
Venue:	NSW DPI Centre for Irrigated Agriculture conference room, Murray Road
Time:	1pm-4:30pm
Contact:	Kristy Bartrop - Industry Development Officer, Wine Grapes Marketing Board ph 6962 3944 e. kbartrop@wgmb.net.au

Southwest Slopes
Viticulture Committee

In conjunction with the Department of Primary Industries & CROPLANDS
Invites you to a workshop on…

Improving Spray Application in the Vineyard

When: Tuesday 14th October 2008, starting at 4.00 pm

Program & venue:

- Indoor seminar (approx 1 hour)
  - Gundagai Wines Nargoon Estates 554 Nangus Rd Gundagai
- Field demonstration session (approx 1.5 hours)
  - Gundagai Wines Nargoon Estates 554 Nangus Rd Gundagai
- BBQ ,Tea/coffee (opportunity to socialise with guest speaker)
  - Gundagai Wines Nargoon Estates 554 Nangus Rd Gundagai

Guest speaker:

- *Dr Andrew Landers, Pesticide Application Specialist, Cornell University, NY, USA*
  - Dr Landers has researched the application of fungicides through commercial sprayers to improve chemical deposition and canopy penetration, while reducing spray drift.
  - He will demonstrate how to improve the efficiency of spraying with minor (inexpensive) modifications to existing equipment using simple techniques to measure airflow, spray distribution, deposition and drift.
  - His work has decreased the amount of fungicide necessary for controlling diseases and reduced the potential impact on the environment.

RSVP: We need to know numbers a few days before the event for catering purposes, so please…

RSVP (by 4.00 pm Friday 10th) – to Yvonne Elliott 02 6933 2508 or yvonne.elliott@dpi.nsw.gov.au

Orange Region Vignerons Association
Viticulture Committee

In conjunction with the Department of Primary Industries
Invites you to a workshop on…

Improving Spray Application in the Vineyard

When: Wednesday 15th October 2008, starting at 2.00 pm

Program & venue:

- Indoor seminar (approx 1 hour)
  - Borenore Store or ANFD function room (depending on numbers) TBA
- Field demonstration session (approx 1.5 hours)
  - Balmoral vineyard, Borenore
- Camp oven BBQ with beer & wine (opportunity to socialise with guest speaker)
  - Balmoral vineyard, Borenore

Guest speaker:

- *Dr Andrew Landers, Pesticide Application Specialist, Cornell University, NY, USA*
  - Dr Landers has researched the application of fungicides through commercial sprayers to improve chemical deposition and canopy penetration, while reducing spray drift.
  - He will demonstrate how to improve the efficiency of spraying with minor (inexpensive) modifications to existing equipment using simple techniques to measure airflow, spray distribution, deposition and drift.
  - His work has decreased the amount of fungicide necessary for controlling diseases and reduced the potential impact on the environment.

Cost: $5.00/ head

RSVP: We need to know numbers a few days before the event so we can choose the best venue for the indoor seminar, and for catering purposes, so please…
RSVP (by 5.00 pm Friday 10th) – to Bob Colton 6361 8964 or bob.colton@gmail.com

VITICULTURE WORKSHOP

Improving Spray Application in the Vineyard

Dr Andrew Landers, Cornell University NY USA

Dr Landers studied and taught agricultural engineering in England. He obtained his masters degree at Cranfield University and his PhD at the University of Bath. His thesis work involved the development of a direct injection crop sprayer, leading to variable rate application in precision farming. He taught agricultural students at the Royal Agricultural College before becoming head of the engineering department at Harper Adams University. He joined the faculty at Cornell University in 1998, and is currently based at the New York State Agricultural Experiment Station in Geneva. He directs the application technology program and his teaching/extension/research appointment involves the use of engineering solutions to provide safer spraying.

Dr Landers development of simple, inexpensive improvements to spray equipment has decreased the amount of fungicide necessary for controlling disease. These improvements have also reduced spray drift and potential impact on the environment. Dr Landers travel is being sponsored by GWRDC and SARDI.

The half day workshops will be in two parts. First meet for a seminar in town and then travel to the vineyard for a field demonstration. Both will be followed by a sausage sizzle with light refreshments.

Seminar – 1 hour followed by a field demonstration

- How droplets are formed and how we can make better use of them
- The answer is blowing in the wind - how airflow affects penetration and deposition - how we can adjust airflow to improve deposition
- Reducing drift - inexpensive ways of getting the spray to the target - modifications from $0 to $24,000
- Developments in vineyard spraying in Europe and North America

Field demonstration – 1.5 hours

- Practical ways to improve deposition and reduce drift - simple modifications to the sprayer
- How can we tell where the spray is going? - effective tracer techniques





Margaret River

Friday 17th October 2008

Margaret River Education Campus
Bussell Highway MARGARET RIVER

Followed by the field demonstration at:
Cape Mentelle
Wallcliffe Road Margaret River

2:00 – 5:00 pm followed by a sausage sizzle

Mount Barker

Monday 20th October 2008

CWA Rooms
32 Albany Highway MOUNT BARKER

Followed by the field demonstration at:
Great Southern Landsdale Vineyard
Denmark – Mount Barker Road Mount Barker

9:00 – 12:00 noon followed by a sausage sizzle

Please RSVP by Wednesday 15th October on Tel: 9777 0000 or E-mail: dfisher@agric.wa.gov.au

Enquiries please contact: Diana Fisher, Viticulture Development Officer, 9777 0128 e-mail as above
Margaret River – Andrew Taylor, Horticulture Pathologist – Tel: 9780 6241 ataylor@agric.wa.gov.au
Mount Barker – Glynn Ward, Viticulture Project Manager – Tel: 9368 3568 gward@agric.wa.gov.au

Sponsors: GWRDC, SARDI, DAFWA, Cape Mentelle, Great Southern Landsdale, Nufarm Australia



DPI Farm Services Victoria(Grapes) in conjunction with the National Wine and Grape Industry Centre and the Yarra Valley Winegrowers Association technical sub committee invite you to a workshop with

Dr Andrew Landers, Cornell University NY USA

Improving Spray Application in the Vineyard:

Dr Landers studied and taught agricultural engineering in England. He obtained his masters degree at Cranfield University and his PhD at the University of Bath. His thesis work involved the development of a direct injection crop sprayer, leading to variable rate application in precision farming. He taught agricultural students at the Royal Agricultural College before becoming head of the engineering department at Harper Adams University. He joined the faculty at Cornell University in 1998, and is currently based at the New York State Agricultural Experiment Station in Geneva. He directs the application technology program and his teaching/extension/research appointment involves the use of engineering solutions to provide safer spraying. His group works with application systems in grapes, apples, vegetables and turf grass and he believes in a multi-disciplinary approach to pesticide application, working with biologists to ensure engineering techniques are biologically effective. Dr. Landers is author of the classic text book, Farm Machinery: Selection, investment and management.

WHERE: Seminar at YVWGA Offices Healesville, Field Demonstration at Domaine Chandon, Maroondah Hwy Coldstream.

Date: 22 October, 2008

TIME: Seminar 1pm - 2pm. Field Demonstration 3pm - 4.30pm

AGENDA:

Seminar 1 Hour

- How droplets are formed and how we can make better use of them
- The answer is blowing in the wind - how airflow affects penetration and deposition - how we can adjust airflow to improve deposition
- Reducing drift - inexpensive ways of getting the spray onto the target - modifications from $0 to $24,000
- Developments in vineyard spraying in Europe and North America

Field demonstration 1.5 Hours

- Practical ways to improve deposition and reduce drift - simple modifications to the sprayer
- How can we tell where the spray is going? - effective tracer techniques

[Click here to register]

For enquiries or more information, please contact Kieran Murphy on 03 92964658 or via email kieran.murphy@dpi.vic.gov.au

WINE INDUSTRY
TASMANIA

Wine Industry Tasmania
Technical Committee

Invites you to a workshop on…

Improving Spray Application in the Vineyard

Program:

Indoor seminar (approx 1 hour)

- How droplets are formed and how we can make better use of them
- The answer is blowing in the wind - how airflow affects penetration and deposition - how we can adjust airfllow to improve deposition
- Reducing drift - inexpensive ways of getting the spray onto the target - modifications from $0 to $24,000
- Developments in vineyard spraying in Europe and North America

Field demonstration session (approx 1.5 hours)

- Practical ways to improve deposition and reduce drift - simple modifications to the sprayer
- How can we tell where the spray is going? - effective tracer techniques

Guest speaker:

Dr Andrew Landers, Pesticide Application Specialist, Cornell University, NY, USA

Dr Landers has researched the application of fungicides through commercial sprayers to improve chemical deposition and canopy penetration, while reducing spray drift.
He will demonstrate how to improve the efficiency of spraying with minor (inexpensive) modifications to existing equipment using simple techniques to measure airflow, spray distribution, deposition and drift.
His work has decreased the amount of fungicide necessary for controlling diseases and reduced the potential impact on the environment.

Date and Venues:

North: - Friday 24th October 2008. 2.00pm. Goaty Hill Vineyard, Auburn Road, Kayena.

South: - Monday 27th October 2008. 2.00pm. Meadowbank, 699 Cambridge Rd, Cmabridge.

Cost: $20.00/ head

RSVP: To Andrea Harmsen, Wine Industry Tasmania by Wednesday 22nd October on 03-6223 3770 or aharmsen@winetasmania.net.au

US spray expert takes regional tour

Katherine Lindh

Australian grapegrowers and winemakers will have the opportunity to meet with US pesticide application technology specialist from Cornell University, Dr Andrew Landers when he visits the country in October this year.

Landers is internationally renowned for his research on spray application, in particular the development of affordable modifications to existing equipment to improve spray application. He will visit approximately 15 wine regions across South Australia, Victoria, New South Wales, Western Australia and Tasmania as part of a regional tour, funded by the Grape and Wine Research and Development Corporation (GWRDC).

During his visit, Landers will deliver workshops to growers and industry personnel, visit wineries and speak to growers about the practices in the USA and applications applicable to Australia.

Dr Mark Sosnowski, research scientist for Horticulture Pathology at the South Australian Research and Development Institute has helped to organise Landers' visit in October.

"The objective of this visit is to provide Australian grapegrowers with information from research in the USA which will lead to improved management of grapevine diseases and pests," Sosnowski said.

The workshops conducted by Landers, will consist of a seminar, followed by a field demonstration.

"In the seminar, Landers will teach growers how droplets are formed and how we can make better use of them," Sosnowski said. "Growers will learn how airflow affects penetration and deposition and how they can improve deposition by adjusting airfllow. Growers will also be shown inexpensive ways of getting the spray onto the target and reducing drift by simple modifications to existing equipment."

"In the field, Landers will demonstrate practical ways to improve deposition and reduce drift by simple modifications to the sprayer. He will also teach growers how to tell where the spray is going using effective tracer techniques.

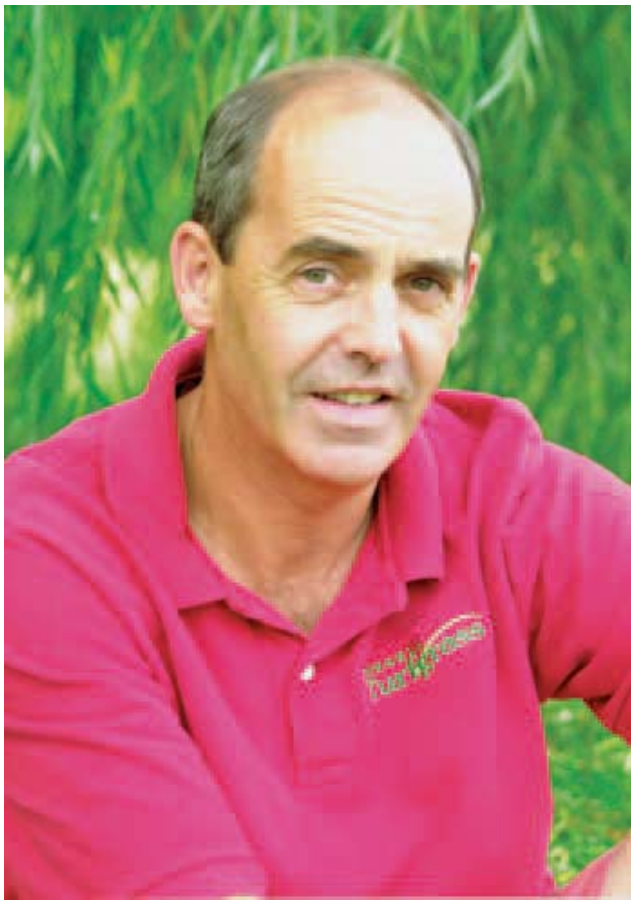
"Landers will also present information on the latest developments in vineyard spraying in Europe and North America," Sosnowski said.

In an interview with Andrew Landers prior to his visit, he told *Grapegrower & Winemaker* his research group at Cornell has spent the past 10 years investigating spray deposition and drift from canopy sprayers working in grapevines.

"Many growers in the USA discover they have spent too much on land, vines, wires, posts, winery tanks etc so they have little available cash for a modern sprayer. We have specialised in very simple, inexpensive methods to modify existing sprayers to improve deposition by upto 30% whilst reducing drift considerably," he said.

Nozzle orientation

Landers' group has conducted numerous sprayer tests with a vertical patternator. "The patternator allows us to see where the spray is actually going, we use an expensive research machine but we have designed a simple patternator, based upon window screens. Another method is to use a 16-foot pole (two 8'x 2" x 4" boards end to end) with a paper tape stapled along the leading edge. Place the pole between two vines within the row and spray a mixture of clean water and food colouring. Travel between the rows, spraying out the mixture. The spray will stain the paper where it hits.



Andrew Landers, application technology specialist, Cornell University, USA.

By looking at the coloured spray droplets on the paper, the farmer can alter the orientation of the nozzles or deflectors until the spray is only hitting the portion of the vertical pole/vines that is desirable," Landers said.

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Tatura Engineering P/L Contact Alex Carter
PH. 0408 241 998 or E-mail acarter@tateng.com.au
Visit Tat-Eng website www.tateng.com.au



Mark Sosnowski, Research Scientist for Horticulture Pathology at the South Australian Research and Development Institute has helped to organise Landers' visit in October.

Air Induction Nozzles (AI)

These nozzles, when used properly, can reduce drift by at least 50%. "The principle behind these nozzles is to create a larger droplet that won't drift as far but still maintain good leaf and fruit coverage. Note, not all AI nozzles are the same. Remember, it is critical to orientate the nozzles as in Step 1 above," he said.

End plates

Landers said in situations where only one side of the sprayer is required, a shroud or plate can be constructed for $US10-20 that can be used to block any air on the opposite side of the sprayer.

VineAccess™

VineAccess is a web-based system that can be used anywhere, to communicate, plan and manage your grape resources.

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"I can enter one spray activity on all blocks"
"I can copy spray events"
"I can pick my PDCs and chemicals"
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"VineAccess frees up time to spend talking to the winery about other things"

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NEW ZEALAND Marlborough Business Resource, 26B Uxbridge St, Renwick, Marlborough T: 03 572 8661 M: 021 902 7700 E: marchant4@xtra.co.nz

Andrew Landers' Australian spraying workshops

Effective spraying of vineyards

classroom session
- how droplets are formed and how we can make better use of them
- the answer is blowing in the wind - how airflow affects penetration and deposition - how we can adjust airfllow to improve deposition
- reducing drift - inexpensive ways of getting the spray onto the target - modifications from $0 to $24,000
- developments in vineyard spraying in Europe and North America

Field demonstration session
- practical ways to improve deposition and reduce drift - simple modifications to the sprayer
- how can we tell where the spray is going? - effective tracer techniques

At this stage, Landers will visit Adelaide Hills, Barossa Valley, Coonawarra, Mt Benson, McLaren Vale, Clare, Loxton, Mildura, Yarra Valley, Griffith, Wagga Wagga, Orange, Margaret River, Mount Barker and Tamar Valley.

For further information about the program please contact Mark Sosnowski on (08) 8303 9489 or sosnowski.mark@saugov.sa.gov.au. For registrations or information about a regional workshop in your area, please contact your local grower association.

On the last couple of rows in the vineyard block you can spray inwards. This way you can reduce drift by at least 50%. This is particularly useful where you have neighbouring water courses, susceptible crops or litigious neighbours.

Foliage sensors

"These sensors tell whether or not the sprayer is next to a vine, automatically shutting the spray off if no vine is present. There are ultrasonic or infrared sensor types and if used properly these reduce your over-spray and drift by 50%. This is an expensive solution but has potential to reduce spray costs by 30%, particularly with young vines upto three years old and during early season spraying," he said.

"Air deflectors or towers to direct the air horizontally rather than upwards or outwards. Tower sprayers are better at targeting the spray into the canopy than a conventional airblast. The conventional air blast sprayer sends droplets in an air blast from a central fan upwards into the canopy whereas the tower sprayer uses a horizontal air curtain. We have developed very simple deflectors, costing less than $100 to make on the farm," he said.

Tunnel sprayers

Tunnel sprayers are the best way to reduce drift. "Very little spray gets out of the tunnel spraying system allowing for a 90% reduction in drift in many vineyards. If AI nozzles are used with the tunnel sprayer 99% of drift can be reduced. We have used tunnel sprayers to monitor the actual volume of spray needed within the canopy as the canopy grows over the season," Landers said.

Avoiding bouncers and drifters



In early season spraying, it is best to turn off or angle higher nozzles to ensure spray is concentrated in the target rows adjacent to the sprayer.

By Laurie Martin

What do a roll of calculator tape, a tennis ball, food dye and marbles all have in common? In the hands of Andrew Landers they become the means for illustrating economical ways of testing sprayer performance and understanding the efficacy of droplets sprayed at different sizes.

Landers, a pesticide application technology specialist with Cornell University based at the New York State Agricultural Experiment Station, was recently in Australia running a series of seminars and demonstrations on behalf of the Grape and Wine Research and Development Corporation (GWRDC).

Australian Viticulture attended the session in the Yarra Valley along with more than 30 growers, organised by Kieran Murphy of DPI Farm Services Victoria (Grapes) in conjunction with the Yarra Valley Winegrowers Association.

The Pesticide Application Technology team at Cornell University perform a number of functions, including testing new spray technology and developing methods to improve deposition and reduce drift. Of most interest to the growers in attendance was the work done by Landers' team to devise economical methods for growers to test the performance of their existing sprayers and modify them to achieve improved performance.

Before moving on to address various ways in which growers might improve the performance of their sprayers, Landers praised the Australian chemical labelling system, which recognises the impact of canopy growth on the amount of product that needs to be sprayed.

"The rest of the world still has old labels that say how many litres per hectare [should be sprayed]. This is rubbish, of course. We have a three dimensional canopy and variable row widths. Changing the volume according to canopy or per 100m-row length is far in advance of anything else in the world. The Europeans are just thinking about this."

Chemical manufacturers have acknowledged that canopy and row width will be different from vineyard to vineyard, so it is important that growers recognise the same fact when it comes to their spraying equipment.



Andrew Landers, application technology specialist, Cornell University, USA.

"In defence of the machinery manufacturers... how can you develop a machine that will spray well on 2m rows or 3m rows? How can you develop a machine that will treat VSP versus Scott Henry versus Sprawl? It's virtually impossible to get one machine to do all things, so growers need to tweak the machine to suit their individual circumstances," Landers said.

One of the key considerations in arriving at the optimum set-up for a sprayer is air, which is used to produce the droplets and move them from the sprayer to the target. The target should be defined as the row next to the sprayer. It is also used to shake the leaves to assist in penetrating the canopy. However, too much air will result in taking droplets past the target as well as excessive shaking of the leaves which, apart from risking leaf damage, may cause the deposited droplets to be removed.

To understand how sprayers do their work, it is necessary to appreciate that larger droplets (<150µm) may bounce excessively while smaller droplets (>300µm) may drift off-target. The aim, therefore, should be to select nozzles that deliver product in a droplet size appropriate for the task at hand.



Andrew Landers explains the process of fixing papers to leaves – there are more economical methods.

For contact products, such as those that work by sitting on the leaf or target insects, a 'fine' nozzle should be considered. For spraying with herbicides to kill leaves or a systemic product requiring the spray to move through the foliage, a 'medium' nozzle is workable, while to spray pre-emergent, soil-active herbicides a 'coarse' nozzle might be best.

Manufacturers of nozzles have done a lot of good work over recent years to produce catalogues that organise nozzle products into these standardised terms, meaning growers have more opportunity to compare nozzles on a performance basis between brands.

However, nozzles do not retain their new performance characteristics forever so it is important to replace them from time to time. Landers suggested that if growers simply kept various nozzles in a tin and brought them out at different times every season, it is likely the holes will become worn by the action of products such as sulfur and produce larger, ineffective drops.

To better control spray drift, the answer lies in airflow. Testing by the Cornell team determined that air induction nozzles were most effective (when compared with traditional hollow cone nozzles) in producing droplets of a suitable size, but drift was even better controlled when other adjustments to a sprayer were employed.

Manufacturers of nozzles have done a lot of good work over recent years to produce catalogues that organise nozzle products into these standardised terms, meaning growers have more opportunity to compare nozzles on a performance basis between brands.

"The first thing to do is set your sprayer for a low gearbox. Hopefully you have a gearbox and, hopefully, you can get it to low. Even so, low is not much lower than 10-15%," said Landers, who went on to discuss the "Cornell doughnut" which is a ring cut from plywood and mounted over the sprayer's air intake to reduce the amount of air going through the sprayer.

As the canopy grows, the space occupied by the doughnut is reduced by using the device cut to smaller sizes. When the canopy reaches full size, the doughnuts are dispensed with entirely. "What could be simpler than a piece of plywood and a jigsaw? It cost about $5 to do these," Landers said.

Testing carried out using this device clearly showed that drift beyond the target row was dramatically reduced.

Landers' other tip for reducing airflow which costs even less than the doughnut option is to leave all the collected dandelions, leaf litter and other rubbish that gets sucked onto the grill of the air intake as it can have the same effect on airflow.

Another simple yet effective option for growers on less sloping land is to reduce their power take-off (PTO) speed when pulling



Andrew Landers demonstrates the use of plastic ribbon on a stick to determine where spray converges and swirls.

a sprayer driven by the PTO. In a test where the PTO speed was reduced from the traditionally accepted 540rpm to 405rpm (a reduction of 20%), deposition (or drift) measured in 6m increments beyond the target row was reduced effectively. At a point 24m beyond the sprayer, coverage of that test station (a pole of approximately 5m with sensors) was reduced from 10% to 0.04%.

Naturally, the operator will need to consider the effect on torque that such a reduction in PTO speed will deliver but, given the possible reduction in chemical use and the fuel reduction likely, the economies involved are worth exploring.

Manufacturers of other sprayer types, including electric fans, are considering the possibility of supplying simple fan speed controls to achieve similar results.

Research into spraying conducted in Italy last year found that the optimum volume of air required to deliver the most effective deposition in the canopy is 2500-3500m^3/ha. "Many sprayers we come across would produce anything between 40-45,000m^3/ha... so shut the air down," Landers said.

The key requirement to ensure effective coverage from any spraying system is to displace or move the air within the canopy rather than through or over it.

Delivering spray to both sides of the canopy at once will result in much better deposition than spraying just one side. However,

DEPARTMENT OF PRIMARY INDUSTRIES

Grape Phylloxera Workshops

The Department of Primary Industries (DPI) works in partnership with the community to manage Victoria's land, water and living resources.

Grape phylloxera is described as the world's worse grapevine pest. Grape Phylloxera Identification and Management Workshops are designed to minimise the impact of this insect on the Australian grape-growing industry.

Grape phylloxera awareness, quarantine procedures, early identification and management options are essential skills for vineyard managers and staff, winemakers, contractors, consultants, viticulture students, quarantine officers and researchers.

This one-day workshop provides the opportunity to gain grape phylloxera identification and management skills during information and practical based sessions. On the day we will have a guest speaker who is a viticulturalist, with phylloxera management experience.

Topics covered include:

- biology and distribution of phylloxera in Australia
- identifying phylloxera symptoms in vineyards
- vineyard survey techniques
- rootstock selection
- quarantine protocols
- risk management
- current, leading edge phylloxera research in Australia.

Where: Northeast Victoria

When: January/February 2009

Cost: $100 (inc. GST) Student discounts apply.

Lunch and refreshments included.
Numbers will be restricted to thirty people, so book early to ensure your place.

For further information and bookings contact: Ginger Korosi, DPI on 02 6030 4500 or email at ginger.korosi@dpi.vic.gov.au

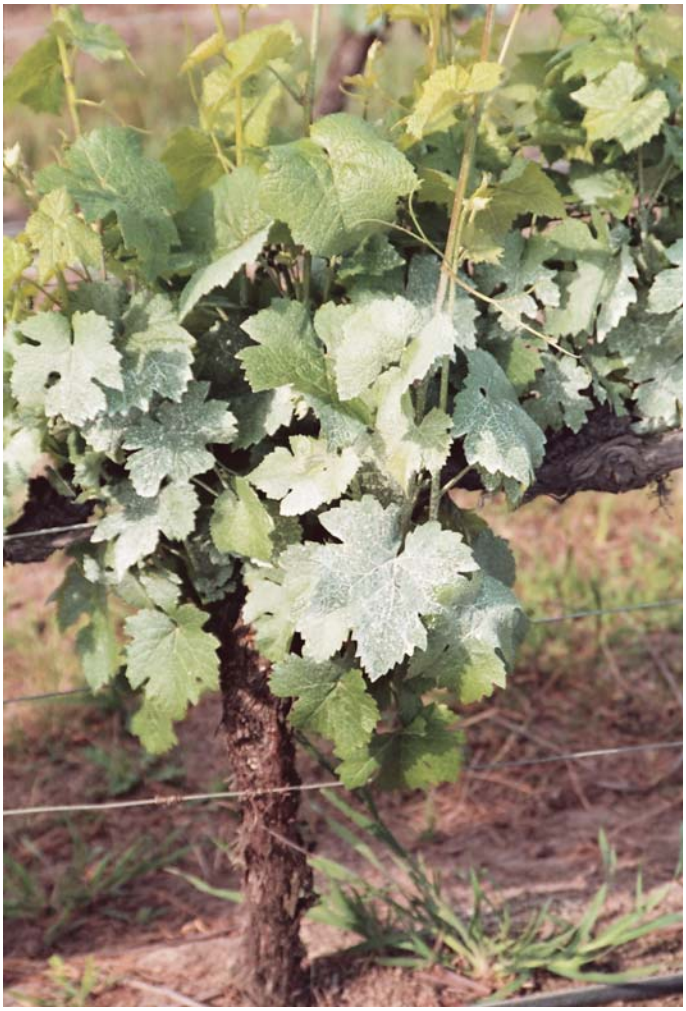
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Vines sprayed with Surround containing kaolin exhibited white powdery residue.



Vine after spraying with Surround to see where spray was deposited.

it is important to angle the spraying heads of double-sided units by 10-15% backwards to avoid a cymbal effect that will occur if the heads or fans are directly facing each other.

Another way of achieving this all-round spray effect is to use a tunnel system. Landers showed a variety of examples of equipment that was either commercially produced or home-made to achieve the aim of surrounding the vine row with spray while capturing and recycling over-spray and avoiding any spray drift. These systems tended to use offset booms rather than fans with the tunnels made from a variety of materials but mainly heavy-duty plastic curtains.

Those attending the seminar were then shown other spray devices currently in research and development, including a system using ultrasonic sensors to determine where foliage is located and activate only those spray heads required to deliver spray to that foliage. Another device designed for variable control is a watchdog system that takes into account wind speed and direction to balance the amount of air being delivered on either side of the spray unit to ensure delivery into the canopy upwind and reduce or eliminate drift downwind. There is also work being done testing permanent overhead structures that deliver irrigation, fertigation and pesticide via emitters.

Moving into the vineyard at Domain Chandon, Landers then showed the group a number of options available to growers to test their sprayer performance in the field. These included using a simple device for measuring wind speed to take the guess work out of determining what that speed actually is, through to making your own spray drop detection equipment.

The first step is to decide on a comfortable forward speed for the tractor pulling the sprayer. The idea is to watch the sprayer in action and observe, ideally, little puffs of spray appearing on the other side of the canopy being sprayed; too slow and more spray will travel further through the canopy than ideal, too fast and the canopy on either side will tend to act as a tunnel and the turbulence set up by the tractor and spray unit may be such that the spray swirls behind the sprayer without effectively penetrating the canopy.

Detecting where spray droplets are travelling in the vineyard (or beyond) can be measured using a number of methods. The method demonstrated on the day involved the use of Surround which contains kaolin, a white clay, in the spray tank that dries to a white powder and is relatively easily seen on the foliage and fruit (and anywhere else) where it lands. Other alternative markers include food dye which is also fairly easy to spot or fluorescent dye that can be spotted under a handheld black light.

Alternatives to the use of commercially available wettable papers were also discussed. To establish the pattern of spray and drift, many papers need to be randomly placed in the general area. At approximately $1 per paper, this can be a fairly expensive exercise. An alternative is to use photographic paper of the type used in domestic computer printers. By cutting the sheets to the size of the wettable papers (a little longer than a standard business card) the cost of sampling material will be heavily reduced.

Another home-made device demonstrated was the fixing of a long pole using cable ties to the trellis wires to gauge not only the distance the spray is travelling, but also the height at which it drifts. The sampling media suggested included food dye in the spray tank and a calculator paper roll stapled to the pole. By noting the date and any other details of the test (distance from target row, height, etc.) on the role paper, different tests can be conducted by simply removing the tape from the pole and re-stapling another, fresh tape in its place.

The use of fluorescent markers and the black light can also provide other interesting information about where the spray is travelling. "The scary bit... is where you can see it has come through the filters of the cab in the tractor, all along the dashboard and there you were thinking the filters were working saving your lungs!"

For more useful tips, papers and links on the subject of spraying technology and getting the most out of your sprayer, visit www.nysaes.cornell.edu/ent/faculty/landers/pestapp/grape.htm (or search for "Andrew Landers Cornell").

In Landers' own words, "You've got the biggest idiot who's ever driven a sprayer in his life driving a sprayer that's not set up at all well... putting this stuff on at label rate and it still works! I suppose the hidden message is, I talk about drift and deposition but I could equally substitute it with reducing pesticide use. Could we not get away with using 25% less if we're putting the stuff on properly? I'm sure we could." ■

