

Airblast Spray Coverage Part 1 Brett Rosenzweig Industry Development Officer

Geoff Furness



Australian Almonds



- Why calibrate?
- Determining the correct water rate
- Winegrape case study
- Nozzle selection criteria
- Canopy coverage assessments
- Lunch
- Field demonstration of calibration





Optimum efficacy:

- Timing
- Dose
- Coverage

Factors affecting amount of chemical impacted:

- Chemical concentration (amount / 100L) label rate
- Spray volume
- Legislation

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Canopy Spraying





Australian Almond Conference 2012



Different size canopies need varying water rates

EFFECT OF CANOPY SIZE AND ROW SPACING ON LEAF AREA AND REQUIRED SPRAY VOLUMES



Orchard 1 - 3.35 m row spacing with young newly planted vines



Orchard 2 - 2.7 m row spacing with large minimal pruned canopy

Orchard 2 has 8.5 times the leaf area index and requires 8.5 times the spray volume of Orchard 1 to achieve the same dose of chemical per unit leaf area.

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New label format for Australia

- -Dilute rate: amount per 100 L
- -Concentrate spraying has maximum concentration specified
- -Chemical rate per hectare deleted
- -Spray quality now specified on new registrations





- Distance calibration
- •New mind shift
- •Litres / 100m / m of canopy height





Canopy Size Calibration Chart for Tree Crops (excluding citrus) -Required Dilute Spray Volume (litres/100m of Row)









Suggested dilute spray volumes (wetness) L/100m/m

-Grapevines	20 - 30
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- -Almonds 20 30
- -Citrus 30 50





Spray Volume Calculator (L / 100m of row)

l/min	3 km/h	4 km/h	5 km/h	6 km/h	7 km/h	8 km/h
60	120	90	72	60	51	45
80	160	120	96	80	69	60
100	200	150	120	100	86	75
120	240	180	144	120	103	90
140	280	210	168	140	120	105
160	320	240	192	160	137	120

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Other useful formulae

- -Length of row / hectare (m) = $10\ 000 \div$ row spacing (m)
- –Number of tanks required =
 - total row length x spray volume \div volume of tank \div 100
 - (m) (litres/100m) (litres)
- -Litres / hectare = litres / 100 m \div row spacing x 100





Canopy Calibration Record

Grower Copy

Canopy Sprayer Setup	STEP 1 - Nozzle Check					STEP 2 - Sprayer Speed
Date	Nozzle Manufacturer		Nozzle Type	7 <u></u>		Measure time in seconds to travel 100 metres
Spray Unit	Specified Output	2	(L/min) @ Pressure	. <u> </u>	kPa	incucs
		LEFT		RIGH	łT	
Tractor	1 <u>6</u> 7	<u> </u>	1	6		Speed (km/h) = 360 ÷
	2 7	12	<u>2</u>	'		(B)
Gearing	<u> </u>	13	<u>s</u>	<u></u>	13 	= km/h
	5 1	0 15		10	<u>14</u> 15	
						OR use chart on outer flap of cover
Sprayer Pressure	Add all nozzle outputs TOTAL OUTPUT (L/mi	n)	(A)			
Weight Used	STEP 3 - Output for Canop	y sprayers				
Check scales using tared measuring jug containing 3 litres of water = 3kg	Actual Spraying Volume =	x 6 ÷	=		x 100 ÷	= L/ha
Scales Correct Y / N	(A) Total output	t (L/min) (I	B) Speed (km/h)		Row Widt	h (m)
	STEP 4 - Product per tank					
Declaration I declare that this is a true and accurate calibration record	Product	t	Chosen lab	el rate /100L	x Tank V	/olume ÷ 100 = Product per tank
					х	÷ 100 =
(Cian shure)					X	÷ 100 =
(Signature)					х	÷ 100 =
					X	÷ 100 =
Data					X	÷ 100 =
Date					x	÷ 100 =
					x	÷ 100 =
Chem User #					x	÷ 100 =

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- 1. Determine water rate required
- 2. Choose spraying speed
- 3. Determine flow rate required
- 4. Choose spraying pressure
- 5. Calculate nozzles needed

Does it match the pump specifications?







Typical Applications:

Excellent: Use for directed applications in air blast spraying for orchards and vineyards and other specialty crops. Also well-suited for applications of insecticides, fungicides, defoilants and foliar fertilizers at pressures of 40 PSI (3 bar) and above. **Good:** For use with defoliants and foliar fertilizers at pressures 40 PSI (3 bar) and above.

Features:

- Maximum operating pressure 300 PSI (20 bar). Spray angle is 80° at 100 PSI (7 bar).
 Finely atomized spray pattern provides
- thorough coverage.

- Longer wear life.
- Resists corrosion.
- Accepts more abrasive pesticide formulation.
- Polypropylene body for use with corrosive materials and ceramic insert.
- Popular nozzle sizes fit most sprayers.
- Incorporates ISO color-coding scheme.









How to order: Specify tip number. Example: TXA8004VK – Ceramic with VisiFlo color-coding

2	()		l/min																	
U	(33)	2 bar	3 bar	4 bar	5 bar	6 bar	7 bar	8 bar	9 bar	10 bar	11 bar	12 bar	13 bar	14 bar	15 bar	16 bar	17 bar	18 bar	19 bar	20 bar
TXA800050VK TXB800050VK (100)	100	0.164	0.196	0.223	0.245	0.266	0.284	0.301	0.317	0.332	0.346	0.359	0.372	0.384	0.396	0.407	0.418	0.429	0.439	0.449
TXA800067VK TXB800067VK (50)	50	0.218	0.262	0.299	0.331	0.360	0.386	0.410	0.433	0.454	0.474	0.493	0.512	0.529	0.546	0.562	0.578	0.594	0.608	0.623
TXA8001VK TXB8001VK (50)	50	0.327	0.393	0.448	0.496	0.539	0579	0.615	0.649	0.681	0.711	0.740	0.767	0.794	0.819	0.844	0.867	0.890	0.912	0.934
TXA80015VK TXB80015VK (50)	50	0.487	0.591	0.678	0.754	0.823	0.886	0.944	0.999	1.05	1.10	1.15	1.19	1.23	1.28	1.32	1.35	139	1.43	1.46
TXA8002VK TXB8002VK (50)	50	0.649	0.788	0.904	1.01	1.10	1.18	1.26	133	1.40	1.47	1.53	1.59	1.65	1.70	1.75	1.81	1.86	1.90	1.95
TXA8003VK TXB8003VK (50)	50	0.968	1.18	1.37	1.53	1.67	1.80	1.93	2.04	2.15	2.25	2.35	2,45	2.54	2.63	2.72	2.80	2.88	2.96	3.03
TXA8004VK TXB8004VK (50)	50	1.29	1.58	1.82	2.03	2.23	2.40	257	2.72	2.87	3.01	3.14	3.27	3.39	351	3.62	3.73	3.84	3.94	4.04



Note: Always double check your application rates. Tabulations are based on spraying water at 70°F (21°C). See pages 124–140 for useful formulas and other information.



	()										l/min									
\cup		2 bar	3 bar	4 bar	5 bar	6 bar	7 bar	8 bar	9 bar	10 bar	11 bar	12 bar	13 bar	14 bar	15 bar	16 bar	17 bar	18 bar	19 bar	20 bar
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- Air & Coverage
 - -Large volume
 - -Low velocity
 - -High turbulence
 - -Air profile and targeting

- Air & Power
 - -Large volume at low velocity
 - -No ducting and bending
 - -No pressurising







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• Fate of spray droplets

Body of table: L/100m ⁻¹	Red Scale hand wand	Oscillating Boom	Airblast
Amount applied	775	665	386
Calculated tree capacity	366	366	403
Estimated total amount sprayed on trees (including branches)	324	317	210
Volume on ground	444	175	15
Balance	8	173	161



Reducing spray drift

- -Increase droplet size
- -Turn off nozzles not aimed at the canopy
- -Match air volume to the canopy
- -Match air and spray profile to the canopy
- -Alter spraying speed
- -Turn off air at end row





Reducing soil contamination

- -Decrease droplet size
- -Use lower spray volumes

-Match air and spray profile to the canopy



Case Study – Wine Industry

- Standard PTO airblast common
- New technology introduced (multi-heads)
- •Water rates 🗸 Speed î No. Rows î
- •Cost of application $extsf{4}$ efficiency, disease control $extsf{1}$
- Drift potential J



Case Study – 27 Ha wine grapes

Equipment	Water Rate (L/Ha)	Speed (kph)	Hours	Cost @ \$25/hr
Airblast	1000	4	30	\$750
Single row Turbomiser	500	6	18	\$450
Two row Turbomiser	500	8	8	\$200
??	333?	10	6?	\$150?



Canopy Coverage Assessments

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Contracted Geoff Furness to rate canopy coverage

- •UV dye sprayed and assessed with a black light
- Four types of airblasts
- Variables ⇒ Speed, water rate and nozzle choice
- •Tree height ⇒6 9m
- 16 treatments
- 4480 leaves collected and visually assessed
- 3200 fruit assessed

🔁 Australian Almond:



•Top third

• Middle third 📃

Bottom third

•North, East, South, West

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Droplet Number Rating Chart

An aid for estimating spray coverage and deposit with agricultural equipment. This chart is a guide only. Impacted droplet size can vary considerably with the formulation and the characteristics of the foliage. Note: $1 \mu I = 1 \text{ mm}^3 = 1 \times 10^{-6}$ litres. 100 microns = 0.1 mm

Droplet No/cm ²	Fine Droplets - Impacted size: 250 microns (dia)	Approx Volume µl/cm ²	Droplet No/cm ²	Medium Droplets • Impacted size: 500 microns (dia)	Approx Volume µl/cm²
10		0.010	10		0.082
25		0.026	25		0.21
50		0.051	50		0.41
100		0.10	100		0.82
200		0.20	200		1.60
500		0.51			
1300		1.30			

Geoff Furness, South Australian Research and Development Institute, Loxton SA 5333



•UV dye droplets on almond fruit

Bottom, outer canopy



outward facing



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•UV dye droplets on almond leaves





top third of outer canopy

bottom third of outer canopy

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- Smaller nozzle sizes produce fine to medium droplet: ① coverage, ① drift potential, ↓ distance
- Which is best??



Canopy Spraying – Nozzle choice Pt1

Treat #	Machine	Tree Height (m)	Canopy Height (m)	Canopy Density	Nozzle Array	Speed (km/hr)	Water Rate (L/100m)
1	Engine fan airblast	9.2	7.7	Sparse/ Medium	Standard	5.5	12.8
2	Engine fan airblast	9.2	7.7	Sparse/ Medium	Fine*	5.5	13.1
3	Engine fan airblast	5.8	5.0	Medium	Fine*	5.5	17.3

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Engine Fan, 5.5kph, Coarse Nozzles, Large Trees





Engine Fan, 5.5kph, Fine Nozzles, Large





Engine Fan, 5.5kph, Fine Nozzles, Medium Trees





What about coverage on the fruit?



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Combined Fruit Coverage



Combined Fruit Coverage







I have a PTO airblast... what is my coverage?

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Canopy Spraying - Current

Freat #	Machine	Tree Height (m)	Canopy Height (m)	Canopy Density	Nozzle Array	Speed (km/hr)	Water Rate (L/100m)
1	PTO driven, twin fan airblast	6.0	4.5	Medium	Standard	5.5	19.3
2	PTO driven, twin fan airblast	6.0	4.5	Medium	Fine*	5.0	19.3
3	PTO driven, single fan airblast	6.0	4.5	Medium	Standard	5.5	19.3

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PTO Twin Fan, 5.5kph, Coarse Nozzles



PTO Single Fan, 5.5kph, Coarse Nozzles



PTO Twin Fan, 5kph, Coarse Nozzles



PTO Twin Fan, 5kph, Fine Nozzles



Combined Fruit Coverage





"You want to do what??"

"Towered sprayers in almonds won't work!!"



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Multi-Head Fan, 5kph, Fine Nozzles









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Canopy Spraying - Speed

Treat #	Machine	L/100m/m tree height	Spraying Speed (km/hr)	Canopy Height (m)
1	Engine driven, twin fan airblast	20	3.5	7.7
2	Engine driven, twin fan airblast	20	5.5	7.7
3	Engine driven, twin fan airblast	20	7.5	7.7



Engine Fan 3.5kph, 20L/100m



Engine Fan 5.5kph, 20L/100m



Engine Fan 7.5kph, 20L/100m



AirOFan 4.6kph, Custom Setup



Combined Fruit Coverage



Combined Fruit Coverage





What effect does WATER RATE have on coverage?



Canopy Spraying – Water Rates

Treat #	Machine	L/100m/m	Spraying Speed	Canopy Height
"		height	(km/hr)	(m)
1	PTO driven, single fan airblast	20	5.5	4.5
2	PTO driven, single fan airblast	25	5.5	4.5
3	PTO driven, single fan airblast	30	5.5	4.5















PTO Fan 5.8kph, 23L/100m, Low



Combined Fruit Coverage



Combined Fruit Coverage



Summary – Water Rates

- 20L/100m/m canopy looks okay for engine driven airblasts
- •25-30L/100m/m canopy height is the best for PTO airblast AT 5.5kph
- Both types of airblast DON'T achieve adequate coverage to consider concentrate spraying





- 3.5kph is best for engine driven airblasts at 20L/100m/m canopy
- PTO airblasts have only been assessed at 5.5kph. Need to assess lower speeds.





- Difficult to spray top third of canopy with current technology
- •Spray from bottom upwards and top downwards??
- New technology or a combination of new and old needed to get even coverage
- Need to take into account impending off-target drift regulations





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Thank You & Questions





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