

# GROWNOTES™

## SPRAY

### APPLICATION MANUAL FOR GRAIN GROWERS

EDITED BY BILL GORDON

FOREWORD BY STEVE JEFFERIES

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CONTRIBUTING AUTHORS

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# Foreword

Spray application is an integral operation in modern grain farming systems. The control of weeds, diseases and pests in a timely manner, while minimising risks to the environment, requires that the spray operator has a good understanding of all of the components that can influence the outcome of each spray job.

This GRDC GrowNotes™ Spray application manual for grain growers, as part of the GRDC GrowNotes™ series has been designed in digital format to provide information on how various spraying systems and components work, along with things the operator should consider to ensure the sprayer is operating to its full potential. The focus of the content is on issues that will assist in maintaining the accuracy of the sprayer output while improving the efficiency and safety of spraying operations.

It includes practical information – backed by science – on sprayer set-up, including self-propelled sprayers, new tools for determining sprayer outputs, advice for assessing spray coverage in the field, improving droplet capture by the target, drift-reducing equipment and techniques, the effects of adjuvant and nozzle type on drift potential, and surface temperature inversion research. The GRDC is continuing to invest in making tools and resources available to growers to assist with spraying decisions.

Bill Gordon, editor and lead author of this manual, has delivered many GRDC training workshops, on improving spray application results and minimising off-target effects. Bill is highly regarded by his peers and by the grains industry as a whole in communicating to spray operators spraying best practice.

In addition, several other key players in the industry have contributed to the production of this manual. They have decades of experience in various aspects of spray application, which they have shared in the 23 modules that make up this GrowNotes™. Each module has a practical focus and, with the addition of video content, there are many 'tips' that applicators will find useful.

We hope GRDC GrowNotes™ Spray application manual for grain growers highlights the need for applicators to plan their operations, and to conduct their own research before upgrading components or replacing the sprayer.

Yours sincerely



**Steve Jefferies**

Managing director  
Grains Research and Development Corporation

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## GRDC GrowNotes™ Spray Application Manual module videos

### Module 1 – The need for planning



#### Introduction to the GrowNotes™



#### An introduction to spraying operations



#### Mixing and handling – custom trailer

### Module 2 – Product requirements



#### Target, timing & technique



#### Weather monitoring using a hand-held meter

## GRDC GrowNotes™ Spray Application Manual module videos

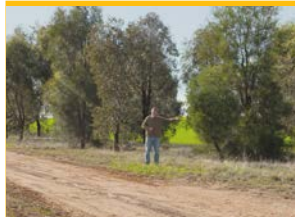
### Module 4 – Drift management strategies



#### Drift reduction technology an introduction



#### Drift reduction technology – vegetative barriers



#### Drift reduction technology – barrier structure

### Module 5 – Spray plans



#### Preparing a spray plan



#### Checking controller inputs & settings



#### Importance of checks for new operators

## GRDC GrowNotes™ Spray Application Manual module videos

### Module 6 – Pre-operational checks



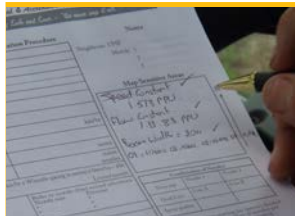
**Boom stability – adjusting boom wear pads**



**Auto height control – checking response and calibration requirements**



**Weighing the sprayer – ways to do it**



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**Pre-operational checks**



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## GRDC GrowNotes™ Spray Application Manual module videos

### Module 6 – Pre-operational checks (continued)



#### Plumbing tip – nozzle numbering

### Module 7 – Mixing and decontamination



#### Chemical mixing order



#### Mixing – conducting a jar test



#### Ammonium sulphate

## GRDC GrowNotes™ Spray Application Manual module videos

### Module 8 – Calibration of the spray system



Options for measuring pressure at the nozzle



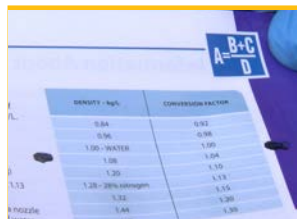
Measuring nozzle pressure and output to check flow meter accuracy



Measuring nozzle output by weight



Keeping a reference nozzle



Impact of density on the accuracy of a calibration



Tank calibration

## GRDC GrowNotes™ Spray Application Manual module videos

### Module 8 – Calibration of the spray system (continued)



#### Fenceline spraying introduction



#### Calibrating fenceline nozzles and banded sprayers

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#### Mixing and handling – custom trailer



#### Mixing and handling water – tankers



#### Mixing and handling – rig features



#### Mixing and handling water quality

## GRDC GrowNotes™ Spray Application Manual module videos

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#### Weather monitoring using a hand-held meter



#### Drift reduction technology – weather stations

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#### Determining pump capacity – diaphragm pump example



#### Plumbing – mounting of flow meters



#### Plumbing – matching nozzle spacing, boom recirculation and single nozzle section control

## GRDC GrowNotes™ Spray Application Manual module videos

### Module 11 – Pumps, plumbing and components (continued)



#### Benefits of boom recirculation



#### Calibration – trailing rig pressure gauges



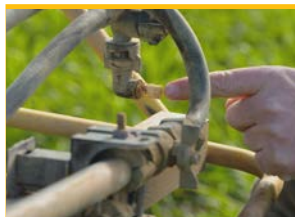
#### Introduction to section control and width



#### Auto section control & chemical savings



#### Plumbing – section width and potential pressures



#### Fenceline nozzle

## GRDC GrowNotes™ Spray Application Manual module videos

### Module 12 – GPS systems

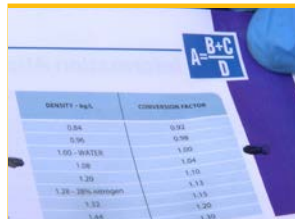


Tyre tip – aligning tyre centres

### Module 13 – Rate controller functions and settings



Rate controller functions – grower experience



DENSITY - kg/L	CONVERSION FACTOR
0.94	0.92
0.96	0.96
1.00 - WATER	1.00
1.08	1.04
1.20	1.10
1.28 - 3000ml/litre	1.18
1.32	1.20
1.44	1.30

Impact of density on the accuracy of the calibration



Using a minimum setting in the rate controller



Checking controller inputs and settings

## GRDC GrowNotes™ Spray Application Manual module videos

### Module 14 – Boom stability and height control



#### Benefits of height-control systems



#### Boom stability – rigid boom centres



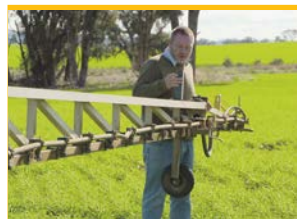
#### Boom stability – pendulum booms



#### Boom stability – inverted trapeze



#### Boom stability – pendulum trapeze boom – Hardi® (coil spring)



#### Height control systems – touchdown or jockey wheels

## GRDC GrowNotes™ Spray Application Manual module videos

### Module 14 – Boom stability and height control (continued)



#### Auto height control grower experience



#### Auto boom height systems

### Module 15 – Weight, balance and tyres



#### Introduction – sprayer weight, balance and tyres



#### Remote systems for checking tyre pressure



#### Tyre information – importance for purchase

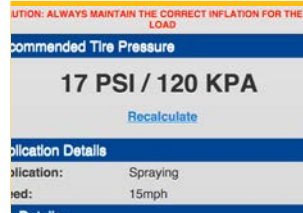


#### Importance of matching tyre pressure to weight on each wheel



## GRDC GrowNotes™ Spray Application Manual module videos

### Module 15 – Weight, balance and tyres (continued)



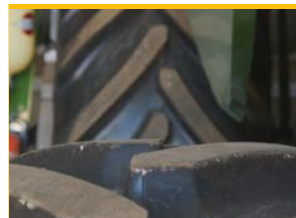
#### Calculating tyre pressure using web-based tools



#### Tyres – tips for assessing tyre pressure

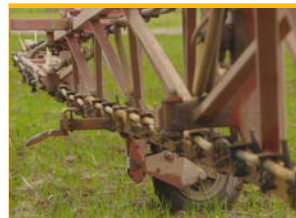


#### Tyre gauges require calibration



#### Tyre tip – aligning tyre centres to improve auto steer function

### Module 16 – Overview of the spraying systems available



#### Spray systems – single line



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## GRDC GrowNotes™ Spray Application Manual module videos

Module 16 – Overview of the spraying systems available  
(continued)



**Single line multi-step system.  
The ARAG® Selectron 4 nozzle  
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**Spray systems – three step dual  
boom**

Module 17 – Pulse-width modulation systems



**Nozzle selection & duty cycle for  
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Module 18 – Single line and multi-step systems



**Spray systems – three tier**



**A growers view on  
multi-step systems**

## GRDC GrowNotes™ Spray Application Manual module videos

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#### Aligning tyre centres

### Module 23 – Upgrading the sprayer



#### Buying a sprayer – a grower perspective



#### Buying a sprayer – part 2

## Contributing authors

### Mr Bill Gordon

Bill Gordon is well known for his work in spray application and drift management in Australia for more than 20 years. As a private consultant, Bill has delivered projects on behalf of the GRDC and other industry groups that have provided training on spraying best practice to over 10,000 Australian grain growers. Bill has also produced numerous publications and fact sheets on spray technology and drift management.



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### Mr David Gooden

David Gooden is a broadacre cropping landowner and director of a family farming operation in southern NSW. He is responsible for managing crop production and spray application. David was awarded a Nuffield Scholarship in 2010 to study responsible pesticide application. He travelled for 16 weeks investigating application, research and regulation of pesticides, along with boom spray, nozzle, and pesticide manufacturing. He travelled to the UK, Ireland, Netherlands, Denmark, Germany, Canada, the USA, Mexico and Brazil. David focuses on maximising chemical effectiveness, reducing losses, timely management and safe operations. Along with his brother, Owen, he has developed a safe chemical transport, handling and mixing system which has been sold throughout NSW, Victoria and SA under the Gooden Welding brand.



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### Mr Craig Day

Craig Day has been delivering accredited chemical application training since 1993. During this time, Craig has also conducted a contract spraying business and farming enterprise. He was awarded a Pratt Foundation/ISS Institute Overseas Fellowship in 2010, specialising in European methodologies for training spray applicators and the requirements for testing sprayer machinery. Craig continues to deliver high-quality, practical spray application training across broadacre, turf and environmental industries.



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### Mr Graham Betts 'GB'

Graham spent nine years at Croplands Spray Equipment before starting ASK GB in 2000. Graham started one-on-one work on-farm, working on sprayers and helping spray application operators get the best out of their sprayers. This led to many years presenting spray application workshops around Australia. Graham is currently helping spray applicators select the best spray application equipment for their needs, matching up all farm machinery, and helping machinery operators get the best out of their machinery tyres and tractors. Helping with tyres includes weighing the tractors and/or machinery, adjusting tyre pressures, checking tractor balance, toe in/out, lead, helping clients select the best tyre for the situation and listing the best tyre pressures for each situation.

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### Dr Tom Wolf

Tom Wolf is an owner of the Canadian-based company Agrimetrix, which specialises in the study of agricultural sprays. Tom has worked in application technology research and extension for more than 20 years, and was instrumental in introducing air-induction and pre-orifice nozzles to Canada. Recently Tom created the website [Sprayers101.com](http://Sprayers101.com) and has developed several useful apps for growers.

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### Mr Andrew Storrie

Andrew Storrie has 36 years of research and extension experience in Australian agriculture. For the past 20 years he has specialised in agricultural and environmental weed management, herbicide resistance management, herbicide use and registration, herbicide drift and pesticide application.

For the past nine years as a private consultant he has been the executive officer of the Australian Glyphosate Sustainability Working Group and delivered 70 workshops for growers and agronomists on integrated weed management for the GRDC as well as better spray application workshops for the GRDC and grower groups. He has written numerous publications, including as major author and editor of the GRDC's *Integrated Weed Management in Australian Cropping Systems*.

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### Dr Jorg Kitt

Jorg Kitt has worked in the agricultural industry for more than 25 years in roles including sales, marketing and sciences. He is involved in product development, training and stewardship. Jorg is an expert in adjuvants and application technology, focusing on improving efficacy and efficiency in broadacre and horticultural crops. He is the author of numerous publications including the *Spraywise* application handbooks.

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### Mr Tim Neale

Tim Neale is an AgTech veteran with over 20 years' experience across many primary industries. Tim has seen the evolution of CTF, GPS autosteer, variable rate technology, big data, and now the internet of things. Tim has presented at over 40 conferences across Australia and internationally, and has managed more than 20 industry projects.

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