GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

GRDC
GROWNOTES

SPRAY APPLICATION MANUAL FOR GRAIN GROWERS

Module 5
Spray plans
Planning for how each product needs to be applied

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Key point

- **The process of completing a spray plan has been designed to encourage the applicator to consider the requirements of the target, the product, the conditions and the situation, and to match the sprayer set-up and operating parameters with label requirements.**

1. Importance of the spray plan

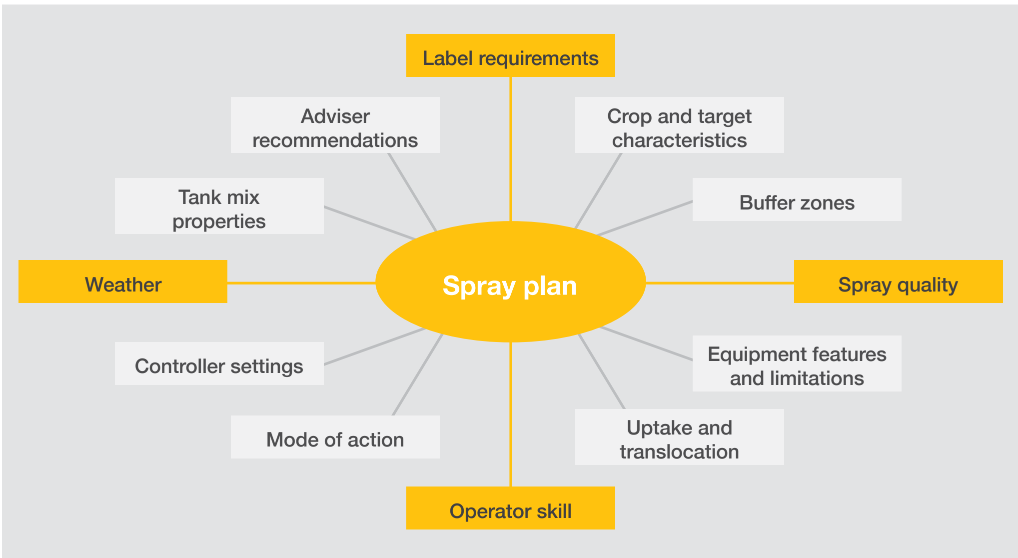
There are many things to consider when making a spray application. Preparing a spray plan helps operators to document these considerations.

The idea of producing a spray plan was first brought to the attention of Australian spray operators by Graham Betts (ASK GB) in the late 1990s as a way of getting them to think about the whole application process before operating the sprayer.

A useful spray plan demonstrates how you have met your legal responsibilities and shows how you have tried to maximise the efficacy of each application.

The completed spray plan should form the basis of your nozzle selection, calibration, sprayer set-up and operation for different spray jobs.

Figure 1 Things that go into a good spray plan.



2. Where to start

There are two things to establish before you prepare a spray plan: the speeds you will spray at and how the products you are using need to be applied.

2.1 Determine the actual range of spraying speeds for all paddocks

Experience will tell most operators what a reasonable spraying speed is for their current sprayer. However, when operating a new spray rig or tractor, a reasonable spraying speed will need to be established before you can make the best decision about the types and orifice size of nozzles that will be required.

It is important to check and record what the range of travel speeds is in each paddock.

Identify paddocks where the layout, obstacles, contour banks, washouts or sandhills are likely to affect spraying speed. Determine what the constant or average travel speed will be in each paddock and work out what the minimum average/constant and maximum travel speeds are likely to be.

This help to determine the minimum pressure, flow and speed for each nozzle type you are considering, as well as the possible need for minor adjustments to the application volume and/or speed to ensure the nozzles are operating correctly and the spray quality is appropriate.

2.2 Make a list of the products likely to be used

Once the speed range of the sprayer has been established, consider what types of products are likely to be applied throughout the season. This allows you (the spray operator) to select and purchase all of your required nozzles, gaskets and caps before the start of the season and therefore prevent delays later on.

Discuss your product requirements with your adviser or agronomist. List all of the jobs you are likely to do and the typical application volumes (litres per hectare) for each. Consult each of the product labels for the spray quality and buffer (no-spray zone) requirements.

TIP

Group similar job and application requirements together before purchasing nozzles

▸ **Link:**
[GRDC Nozzle Selection Guide]

*These application volumes and spray qualities are examples only. Your requirements may vary depending on product label, stubble load, canopy size, conditions, and presence of sensitive areas.

For example, spray jobs that most grain growers would undertake throughout the season would include:

- **fallow spraying;**
  - translocated herbicides (60 to 75L/ha, coarse or larger)*; and
  - contact herbicides or double-knocks (80 to 100L/ha, medium or coarse)*.
- **pre-emergent applications (100L/ha, coarse or larger)*;**
- **early broadleaf control (70 to 80L/ha, coarse)*;**
- **grass-selective sprays in-crop (80 to 100L/ha, medium or coarse)*;**
- **fungicide and insecticide in-crop (80 to 150L/ha, medium or larger)*; and**
- **pre-harvest desiccation: (80 to 120L/ha, coarse or medium)*.**

2.3 Identify how many nozzle set-ups will cover the range of applications you may need to do

Summarising the examples listed in section 2.2 above, we could come up with four set-ups to cover all situations:

- **low volume coarse (60 to 75L/ha);**
- **high volume coarse (80 to 100L/ha);**
- **low volume medium (80 to 100L/ha); and**
- **high volume medium (120 to 150L/ha).**

If maintaining a reasonable travel speed to ensure good timing is your priority, then these four set-ups may require four different sets of nozzles. However, if you are willing to adjust your travel speed (without sacrificing too much efficiency or timeliness), it may be possible to achieve these four set-ups with just two or three sets of well-chosen nozzles.

For example, by slowing down and increasing the application volume, it may be possible to use the same nozzle set-up for translocated herbicides as for pre-emergent herbicides or for pre-harvest desiccation. Similarly, the nozzle set-up used for grass-selective sprays may be used for fungicides if the spraying speed is reduced and the application volume increased.

2.4 Consider sensitive areas, buffer requirements and suitable conditions for spraying

Good farm maps highlighting sensitive areas are essential for planning applications and are important for spray operators to have available when spraying. Knowing where the sensitive areas may be on your property and on neighbouring farms is important to consider for any spray job, particularly in relation to wind direction and label buffer zones.

3. Things that are required to be able to complete a spray plan

To complete a spray plan there are several things for the operator to look into or to calculate.

Before starting this process it is important to have the following materials available:

- **product labels and your adviser's recommendations;**
- **a manufacturer's nozzle chart for orifice size, pressure and flow rate;**
- **a spray quality chart for the nozzles you may be considering;**
- **a calculator;**
- **a summary of the formula required for calculations (see page 6);**
- **a blank spray plan template (see page 7); and**
- **access to online tools for assessing or adjusting buffer-zone distances.**

Table 1 Litres per-minute per nozzle chart.

Pressure at nozzle (bar)	Litres per minute per nozzle (L/min/nozzle) for various orifice size and pressure combinations						
	Orifice size						
	01	015	02	025	03	035	04
1.0	0.23	0.34	0.46	0.57	0.68	0.80	0.91
1.5	0.28	0.42	0.56	0.70	0.84	0.98	1.12
2.0	0.32	0.48	0.64	0.81	0.97	1.13	1.29
2.5	0.36	0.54	0.72	0.90	1.08	1.26	1.44
3.0	0.39	0.59	0.79	0.99	1.18	1.38	1.58
3.5	0.43	0.64	0.85	1.07	1.28	1.49	1.71
4.0	0.46	0.68	0.91	1.14	1.37	1.60	1.82
4.5	0.48	0.73	0.97	1.21	1.45	1.69	1.93
5.0	0.51	0.76	1.02	1.27	1.53	1.78	2.04
5.5	0.53	0.80	1.07	1.34	1.60	1.87	2.14
6.0	0.56	0.84	1.12	1.40	1.67	1.95	2.23
6.5	0.58	0.87	1.16	1.45	1.74	2.03	2.32
7.0	0.60	0.90	1.21	1.51	1.81	2.11	2.41
7.5	0.62	0.94	1.25	1.56	1.87	2.18	2.50
8.0	0.64	0.97	1.29	1.61	1.93	2.26	2.58

3.1 Useful formulas and terms

Width can refer to

- **nozzle spacing (metres) for broadcast/boom spraying;**
- **spray width (m) for band spraying or boomless spraying;**
- **spray width (m) for band spraying divided by the number of nozzles; and**
- **row spacing (m) divided by the number of nozzles per row for directed spraying.**

Note: These examples refer to litres per sprayed hectare (L/ha)

Litres per hectare = L/min/nozzle x 600 ÷ speed (kilometres/hour) ÷ width (m)

Litres per minute per nozzle = L/ha x width (m) x speed (km/h) ÷ 600

Speed (km/h) = L/min/nozzle x 600 ÷ L/ha ÷ width (m)

Nozzle spray width (m) = L/min/nozzle x 600 ÷ L/ha ÷ speed (km/h)

Total flow rate through boom (L/min) = L/min/nozzle x number of nozzles used

New pressure (bar) = new output (L/min) x new output (L/min) x known pressure (bar) ÷ known output (L/min) ÷ known output (L/min)

New output (L/min) = (√new pressure (bar)) x known output (L/min) ÷ (√known pressure (bar)

Controller L/ha formula = spray width ÷ crop row width x L/ha
This is to be entered into the controllers. For example, 0.35m ÷ 1.0m x 80 = 24 L/ha on the paddock and controller hectares.

Spray plan part 1

Figure 2 Example of a blank spray plan to document and justify modified buffer zones.

Spray plan	**Product and nozzle choice, operating parameters and buffer details**					
Name:				Date:		
Sprayer details:						
Spray job and target:						
Paddock name or ID:						
Situation	Standard label buffer			Modified buffer		
Product names and rate:			rate			rate
How do the products need to be applied according to label, adviser or buffer zone calculator?	Speed range (km/h)			Speed range (km/h)		
	Application volume (L/ha)			Application volume (L/ha)		
	Spray quality			Spray quality		
Is a label downwind buffer zone required?	Standard		(m)	Modified		(m)
APVMA Buffer Zone Calculator Inputs	Nozzle height (m):			Other:		
	Wind direction from:			Other:		
Number of nozzles used		Boom width (m)		Nozzle spacing (m)		= W

Spray plan part 2

Steps to select nozzles and operating parameters:

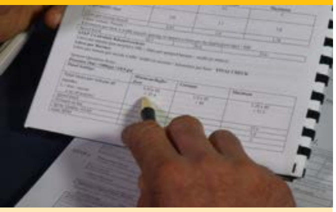
1. Calculate required flow rate for the nozzles **(L/minute/nozzle) = L/ha x speed km/h x width (m) ÷ 600**
2. Choose nozzle size, type and operating pressure to match label or buffer requirements and sprayer's ability
3. Determine the minimum and maximum speed to run the selected nozzles (to operate effectively and maintain spray quality)
4. Determine the L/min/nozzle at the minimum, constant and maximum pressures and calculate total flow through boom.

Nozzles selected and operating parameters		**Standard label buffer**			**Modified buffer**		
	Nozzles selected for each situation						
	Total application volume (L/ha)						
	Look into or calculate	Minimum	Constant	Maximum	Minimum	Constant	Maximum
	Pressure at nozzle (bar)						
	Spray quality						
	Spraying speed (km/h)						
	L/minute/nozzle						
	Total flow through boom (L/min)						

Comments (e.g. sprayer type used, specific set-up, buffer calculation or sensitive area):

4. Complete the spray plan

PLAY VIDEO



Preparing a spray plan

Spray plan part 1

Note: This is a generic example. It does not include actual product names or buffer distances.

4.1 Complete the job details and label requirements in the top half of the form (Part 1 of the spray plan)

For example, a summer fallow application using a 36.6-metre boom, (20-inch nozzle spacing = 0.508m) with possible sensitive area adjacent to the paddock.

Part 1 of the spray plan is about the sprayer, the products and the label requirements. In this example the spray plan includes two situations: the standard label buffer (or no-spray zone) and a modified buffer. The option to modify the buffer may be available to the operator by consulting Australian Pesticides and Veterinary Medicines Authority (APVMA) rules and calculators for this purpose.

Figure 3 Example of a completed spray plan documenting modified buffer zones.

Spray plan		Product and nozzle choice, operating parameters and buffer details					
Details for spray job, equipment used and buffer inputs	Name:	Bill Bloggs			Date:	3/1/2015	
	Sprayer details	Self-propelled sprayer – auto-height control					
	Spray job and target	Summer fallow – broadleaf and summer grasses					
	Paddock name or ID	River Block					
	Situation	Standard label buffer			Modified buffer		
	Product name and rate			rate			rate
		Group I herbicide		1.0L/ha	Group I herbicide		1.0L/ha
		Glyphosate 450		1.5L/ha	Glyphosate 450		1.5L/ha
					Low drift adjuvant		0.2L/100L
	How do the products need to be applied according to label, adviser or Buffer Zone Calculator?	Speed range (km/h)	16–24km/h		Speed range (km/h)	14–20km/h	
		Application volume (L/ha)	60L/ha		Application volume (L/ha)	80L/ha	
		Spray quality	Coarse		Spray quality	Extra coarse	
	Is a Label Downwind Buffer Zone required?	Standard	XXX	(m)	Modified	YYY	**(m)**
	APVMA Buffer Zone Calculator inputs	**Nozzle height (m):**		0.5m	**Other:**	Low-drift adjuvant added	
		Wind direction from:		120°	**Other:**		
	Number of nozzles used	72	Boom width (m)	36.6m	Nozzle spacing (m)	0.508m	= W

If the spray operator uses approved tools or calculators to modify label-buffer distances, this information will have to be recorded. The spray operator will also need to demonstrate how the machine was operated to match the parameters used to calculate the modified buffer. This is why Part 2 of the spray plan is also very important.

Part 2 of the spray plan includes nozzle selection details and operating parameters to match the sprayer set-ups identified in Part 1 (see Figure 3) of the spray plan.

4.2 Select nozzles and operating parameters for the job (Part 2 of the spray plan)

Step 1. Determine the required flow rate (nozzle size and pressure)

Once we have determined the total application volume (total litres per hectare), a decision about nozzle orifice size and pressure needs to be made.

To do this we need to determine the required flow rate for each nozzle (litres/minute/nozzle).

From our example (Figure 3):

Standard buffer:

60L/hectare, coarse spray quality, 16–24km/h, nozzle spacing (W) = 0.508m*

***Note that because the nozzle spacing is 0.508m we have to calculate the required L/minute/nozzle. If the nozzle spacing was 0.5m we could use a standard nozzle chart to select the nozzle orifice size and pressure.**

Formula required: ***L/min/nozzle = L/ha x width (m) x speed (km/h) ÷ 600***

at 24km/h L/min/nozzle = 60 x 0.508 (m) x 24 ÷ 600
= 1.22 litres per minute per nozzle (at 24.0km/h)

at 16km/h L/min/nozzle = 60 x 0.508 (m) x 16 ÷ 600
= 0.81 litres per minute per nozzle (at 16.0km/h)

Once you have established the required L/minute/nozzle, look up the nozzle sizes and flow rates using a manufacturer's nozzle chart to achieve 1.22L/min/nozzle and 0.81L/minute/nozzle.

Choices:

1.22L/minute/nozzle (24.0km/h)
02 orifice at 7.0 bar
025 orifice at 4.5 bar
03 orifice at between 3.0 bar and 3.5 bar
04 orifice between 1.5 bar and 2.0 bar

0.81L/minute/nozzle (16.0km/h)
02 orifice between 3 bar and 3.5 bar
025 orifice at 2.0 bar
03 orifice between 1.0 bar and 1.5 bar
04 orifice less than 1.0 bar

Decide on a practical nozzle orifice size and pressure to suit your machine.

The 03 and 04 orifices will reduce in pressure too much when you slow down.

The 02 orifice would require that the machine is capable of operating at 7.0 bar and that a nozzle can operate at that pressure and produce a coarse droplet, which would limit the choice to a high-pressure air-induction nozzle.

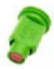
The 025 orifice at 4.5 bar at 24.0km/h is probably the best choice for this example.

Step 2: Select the nozzle brand and type based on spray quality

Having established that we want to use a nozzle with a 025 orifice (lilac) at 4.5 bar at 24km/h (and 2.0 bar at 16km/h), we have to choose a nozzle brand and type that will produce the coarse spray quality required across that range of pressures.

From the manufacturer's spray quality data for lilac 025 orifice low-pressure air-induction nozzles, we find there are several nozzles available, but not all can be used.

Table 2 Low-pressure air-induction spray quality.

Run above 2.0 bar to 3.0 bar												
BRAND		Agrotop	Lechler®	Hardi	Hardi	Lechler®	Hypro	Hypro	TeeJet®	Bille-ricay	Albuz®	Hypro/ Spray-master
MODEL		Airmix	IDK-120	Minidrift-DUO twinjet	Minidrift	IDKT twinjet	Guardian Air	Guardian Twin Air	AIXR	bubble-jet	CVI	Drift Beta/ ULD
Nozzle size	Bar											
025 LILAC	1.5		VC	VC	VC		XC		XC	XC		
	2.0	VC	VC	VC	VC	not available in this size	VC	VC	XC	XC	C	VC
	3.0	C	C	C	C		C	C	VC	VC	C	C
	4.0	C	C	C	C		M	M	C	C	C	C
	5.0	M	M	M	M		M	M	C	C	M	C
	6.0	M	M	M	M		M	M	C	C		M
	7.0						M	M		C		M
	8.0						M	M				M

Source: GRDC Nozzle Selection Guide, 2015

Before making the final selection, consider the spray quality at the average or constant pressure, as well as the minimum pressure when you slow down.

For this example, the TeeJet® AIXR 110-025 VP was chosen as the nozzle holds a coarse spray quality up to 6.0 bar. However, care will be needed to minimise the amount of time at the minimum speed where the pressure will be 2.0 bar as with this nozzle the spray quality can become extremely coarse.

Step 3: Calculate the maximum speed for this nozzle to maintain the spray quality at 60L/ha

The TeeJet® AIXR 110-025 VP holds a coarse spray quality up to 6.0 bar.
(Look up the flow rate of an 025 orifice at 6.0 bar which = 1.40L/minute/nozzle.)
To determine the maximum spraying speed to maintain a coarse spray quality:

Formula required: Speed (km/h) = L/min/nozzle x 600 ÷ L/ha ÷ width (m)
= 1.40L/min/nozzle x 600 ÷ 60L/ha ÷ 0.508 (m)
= 27.6km/h

Figure 4 Example completion of Part 2 of the spray plan.
Enter this information into the bottom half of the spray plan.

Nozzles selected and operating parameters	**Nozzles selected for each situation**	**Standard label buffer**			**Modified buffer**		
		TeeJet AIXR 110-025					
	Total application volume (L/ha)	60					
	Look up or calculate:	Minimum	Constant	Maximum	Minimum	Constant	Maximum
	Pressure at nozzle (bar)	2	4.5	6			
	Spray quality	XC	C	C			
	Spraying speed (km/h)	16	24	27.5			
	L/minute/nozzle	0.81	1.22	1.40			
	Total flow through boom (L/min)						

Comments (e.g. sprayer type used, specific set-up, buffer calculation or sensitive area):

Once you have transferred the calculations you have made so far, you will see there is one piece of information missing – the total flow rate (L/min) through the boom. This is an important piece of information to be able to use the controller display to check how things are running during the spray job.

Step 4: Calculate the total flow rate through the boom

The total flow rate through the boom is based on the number of nozzles being used (72 in this example), and the flow rate of each nozzle (L/minute/nozzle) at each of the spraying speeds.

Determine the total flow rate through the boom at each speed with the following formula:
Total flow rate through boom (L/min) = L/minute/nozzle x number of nozzles used

at **16km/h** Total flow rate through boom (L/min) = 0.81 x 72 = **58.32** (L/min)
at **24km/h** Total flow rate through boom (L/min) = 1.22 x 72 = **87.84** (L/min)
at **27.5km/h** Total flow rate through boom (L/min) = 1.40 x 72 = **100.8** (L/min)

Add this final piece of information to the bottom half of the spray plan to complete the plan for the standard buffer (see Figure 4).

Figure 5: Example of a completed plan for the standard buffer.

Spray plan part 1

Name:	Bill Bloggs			**Date:**	3/1/2016	
Sprayer details:	Self-propelled sprayer – auto-height control					
Spray job and target:	Summer fallow – broadleaf and summer grasses					
Paddock name or ID:	River Block					
Situation	Standard label buffer			Modified buffer		
Product names and rates:			rate			rate
	Group I herbicide		1.0 L/ha	Group I herbicide		1.0L/ha
	Glyphosate 450		1.5 L/ha	Glyphosate 450		1.5L/ha
				Low-drift Adjuvant		0.2L/100L
How do the products need to be applied according to label, adviser or Buffer Zone Calculator?	**Speed range (km/h)**	16.0 - 24.0km/h		**Speed range (km/h)**	14.0 – 20.0km/h	
	Application volume (L/ha)	60 L/ha		**Application volume (L/ha)**	80 L/ha	
	Spray quality	Coarse (C)		**Spray quality**	Extra Coarse (XC)	
Is a label downwind buffer zone required?	**Standard**	XXX	(m)	**Modified**	YYY	(m)
APVMA Buffer Zone Calculator inputs	**Nozzle height (m):**		0.5M	**Other:**	Low-drift adjuvant added	
	Wind direction from:		120°	**Other:**		
Number of nozzles used	72	**Boom width** (m)	36.6m	**Nozzle spacing (m)**	0.508m	= W

Spray plan part 2

Steps to select nozzles and operating parameters:

1. Calculate required flow rate for the nozzles (L/minute/nozzle) = L/ha x speed km/h x width (m) ÷ 600
2. Choose nozzle size, type and operating pressure to match label or buffer requirements and sprayer's ability
3. Determine the minimum and maximum speed to run the selected nozzles (to operate effectively and maintain spray quality)
4. Determine the L/min/nozzle at the minimum, constant and maximum pressures and calculate total flow through boom.

Nozzles selected and operating parameters

Nozzles selected for each situation	**Standard label buffer** TeeJet® AIXR-110-025 VP			**Modified buffer**		
Total application volume (L/ha)	60					
Look into or calculate	Minimum	Constant	Maximum	Minimum	Constant	Maximum
Pressure at nozzle (bar)	2.0	4.5	6.0			
Spray quality	XC	C	C			
Spraying speed (km/h)	16.0	24.0	27.5			
L/minute/nozzle	0.81	1.22	1.40			
Total flow through boom (L/min)	58.32	87.84	100.8			

Comments (e.g. sprayer type used, specific set-up, buffer calculation or sensitive area):

4.3 Complete the spray plan for a modified buffer (Part 2)

In this instance we are using an Extremely Coarse (XC) spray quality, at 14–20km/h and at a total application volume of 80L/ha (with the addition of a drift-reduction adjuvant).

Use the same process you employed for determining the spray plan for the standard buffer to determine the nozzle type and operating parameters.

Step 1: Determine the required flow rates (litres per minute per nozzle)

Formula required: ***L/min/nozzle = L/ha x width (m) x speed (km/h) ÷ 600***

at 20km/h L/min/nozzle = 80 x 0.508 (m) x 20 ÷ 600
= 1.35 litres per minute per nozzle (at 24.0km/h)

at 14km/h L/min/nozzle = 80 x 0.508 (m) x 14 ÷ 600
= 0.95 litres per minute per nozzle (at 14.0km/h)

Once you have established the required L/minute/nozzle look up the nozzle sizes and flow rates using a manufacturer's nozzle chart to achieve 1.35L/min/nozzle and 0.95L/min/nozzle.

Choices:

1.35L/min/nozzle (20km/h)	**0.95L/min/nozzle (14km/h)**
025 orifice at 5.5 bar	025 orifice between 2.0 bar and 2.5 bar
03 orifice at 4.0 bar	03 orifice between 1.0 bar and 1.5 bar

Decide on a practical nozzle size and pressure to suit your machine.
The 03 orifices will reduce in pressure too much when you slow down.

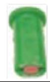
The 025 orifice at 5.5 bar at 20.0km/h is probably the best choice for this example.

Step 2: Select the nozzle brand and type based on spray quality

Having established we want to use a nozzle with a 025 orifice (lilac) at 5.5 bar at 20km/h (and 2.0 bar at 14km/h), we now have to choose a nozzle brand and type that will produce the Extremely Coarse (XC) spray quality required across that range of pressures.

From the manufacturer's spray quality data for lilac 025 orifice nozzles (Table 3), there is actually only one choice that will match these criteria, the TeeJet® TTI 110-025 VP (Turbo TeeJet Induction Flat Spray Tips).

Table 3 High-pressure air-induction spray quality.

Run above 2.0 to 3.0 bar							
BRAND		Hardi	Lechler	Albuz	TeeJet®	TeeJet®	TeeJet®
MODEL		Injet	ID	AVI	AITTJ60 twinjet	AI	TTI
Nozzle size	Bar						
025 LILAC	1.5				UC		UC
	2.0				XC	UC	UC
	3.0	VC	VC	VC	VC	XC	UC
	4.0	VC	VC	C	VC	XC	UC
	5.0	VC	VC	C	C	VC	XC
	6.0	VC	C	C	C	VC	XC
	7.0	VC	C	C	M	C	XC
	8.0	VC	C	C		C	
Source: GRDC Nozzle Selection Guide, 2015							

Step 3: Calculate the maximum speed for this nozzle to maintain the spray quality at 80L/ha

The TeeJet® TTI 110-025 VP holds a coarse spray quality up to 7.0 bar.
(Look up the flow rate of an 025 orifice at 7.0 bar which = 1.51L/minute/nozzle.)

To determine the maximum spraying speed to maintain a Extremely Coarse (XC) spray quality:

Formula required:

Speed (km/h) = L/min/nozzle x 600 ÷ L/ha ÷ width (m)
= 1.51 L/min/nozzle x 600 ÷ 80 L/ha ÷ 0.508 (m)
= 22.3 km/h

Step 4: Calculate the total flow rate through the boom (L/minute)

The total flow rate through the boom is based on the number of nozzles being used – 72 in this example – and the flow rate of each nozzle (L/min/nozzle) at each of the spraying speeds.

Determine the total flow rate through the boom at each speed.

Formula required:

Total flow rate through boom (L/min) = L/min/nozzle x number of nozzles used

at **14km/h:** Total flow rate through boom (L/min) = 0.95 x 72 = **68.40** (L/min)
at **20km/h:** Total flow rate through boom (L/min) = 1.35 x 72 = **97.20** (L/min)
at **22.3km/h:** Total flow rate through boom (L/min) = 1.51 x 72 = **108.72** (L/min)

Add this information to the bottom half of the spray plan (Part 2) and the plan for the modified buffer.

Spray plan part 1

PLAY VIDEO

Checking controller inputs & settings

To test the spray plan before spraying go to Module 6: Pre-operational and regular checks

Spray plan part 2

Figure 6 Example of a completed spray plan.

Sprayer details	Self-propelled sprayer – auto height control					
Spray job and target	Summer fallow – broadleaf and summer grasses					
Paddock name or ID	River Block					
Situation	Standard label buffer			Modified buffer		
Product names and rate			rate			rate
	Group I herbicide		1.0 L/ha	Group I herbicide		1.0 L/ha
	Glyphosate 450		1.5 L/ha	Glyphosate 450		1.5 L/ha
				Low-drift adjuvant		0.2L/ 100L
How do the products need to be applied according to label, adviser or Buffer Calculator?	Speed range (km/h)	16.0 - 24.0 km/h		Speed range (km/h)	14.0 – 20.0 km/h	
	Application volume (L/ha)	60 L/ha		Application volume (L/ha)	80 L/ha	
	Spray quality	Coarse (C)		Spray quality	Extra Coarse (XC)	
Is a label downwind buffer zone required?	Standard	XXX	(m)	Modified	YYY	(m)
APVMA Buffer Zone Calculator inputs	Nozzle height (m):		0.5M	Other:	Low-drift adjuvant added	
	Wind direction from:		120 degrees	Other:		
Number of nozzles used	72	Boom width (m)	36.6m	Nozzle spacing (m)	0.508m	= W

Steps to select nozzles and operating parameters:

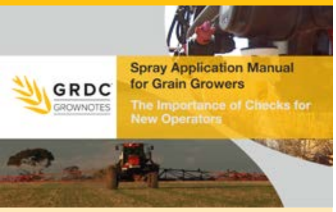
1. Calculate required flow rate for the nozzles **(L/minute/nozzle) = L/ha x speed km/h x width (m) ÷ 600**
2. Choose nozzle size, type and operating pressure to match label or buffer requirements and sprayer's ability
3. Determine the minimum and maximum speed to run the selected nozzles (to operate effectively and maintain spray quality)
4. Determine the L/min/nozzle at the minimum, constant and maximum pressures and calculate total flow through boom.

Nozzles selected and operating parameters

Nozzles selected for each situation	**Standard label buffer** TeeJet® AIXR 110-025 VP			**Modified buffer** TeeJet® TTI 110-025 VP		
Total application volume **(L/ha)**	60			80		
Look up or calculate	Minimum	Constant	Maximum	Minimum	Constant	Maximum
Pressure at nozzle **(bar)**	2.0	4.5	6.0	2.0	5.5	7.0
Spray quality	XC	C	C	UC	XC	XC
Spraying speed **(km/h)**	16.0	24.0	27.5	14.0	20.0	22.3
L/minute/nozzle	0.81	1.22	1.40	0.95	1.35	1.51
Total flow through boom **(L/min)**	58.32	87.84	100.8	68.40	97.20	108.72

Comments (e.g. sprayer type used, specific set-up, buffer calculation or sensitive area)
A detailed farm map showing sensitive areas should be attached to this spray plan.

PLAY VIDEO



Importance of checks for new operators

5. Know when to make adjustments

5.1 Consider appropriate minimum operating pressures for the nozzles chosen

When operating the selected nozzles and pressure combinations, it may become apparent that for some situations the minimum pressure is too low for some nozzles to function effectively. If this occurs, consider increasing the application volume (or travel speed) to increase the pressure at the nozzle, making adjustments to the spray plan as required.

5.2 Recognise that some tank mixes may require compromise

The mode of action of some products that may be included in a tank mix can require quite different application set-ups. For example, when tank mixing a contact product and a soil-applied product. When this occurs a decision has to be made about how you can compensate.

For example, if the droplet size selected favours soil deposition, then the volume may have to be increased to maintain efficacy with the contact product. If this is not practical, then perhaps the products should be applied as two separate applications.

6. Conclusion

The first time you complete a spray plan it will seem like a daunting process; however, the process becomes faster and easier with each one you do.

It is important to remember that once your spray plan is in place, it forms the basis of your calibration as most of the calculations are already done.

The spray plan also becomes a guide to sprayer set-up and knowing what nozzles will be required.

The figures calculated for speed, pressure and flow form the basis of how you should set up the rate controller and what to look for on the screen to indicate things are running smoothly while you are spraying.

The spray plan demonstrates that you have considered all aspects of the spray job and forms a record of how you applied each product. This will become increasingly important as applicators may wish to modify buffer zones to suit the situation or tank mix.

NEXT MODULE

SPRAY APPLICATION MANUAL FOR GRAIN GROWERS

Module 6 Pre-operational checks Keeping everything running smoothly

GRDC GROWNOTES

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