

# MAINTAINING EFFICACY WITH LARGER DROPLETS – 2,4-D APPLICATION REQUIREMENTS

# FACT SHEET



**GRDC**  
GRAINS RESEARCH  
& DEVELOPMENT  
CORPORATION

**NATIONAL**  
REVISED DECEMBER 2022



Photo: Brad Collins

Many of the nozzles used by grain growers may not be able to produce a very coarse (or coarser) spray quality at practical operating pressures. Spray operators may need to change from low pressure air induction nozzles to high pressure air induction nozzles that can produce the very coarse (VC), extremely coarse (XC) or ultra coarse (UC) spray qualities specified by the new 2,4-D labels (see [Table 1](#), on page 2, for examples of common nozzle types and the spray qualities produced at various pressures).

## Impact of coarser spray qualities on coverage

An increase in droplet size by moving to coarser spray qualities can have a significant impact on the number of droplets generated and the potential spray coverage of target weeds, unless the total application volume (L/ha) is also increased (see [Figure 1](#)).

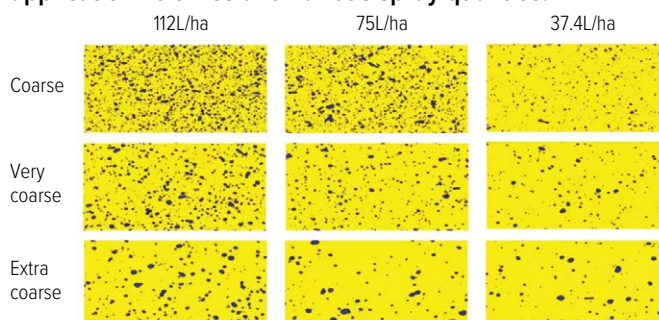
An increase in droplet size can also impact on the ability of many of the larger droplets to be retained on certain leaf surfaces, with a proportion of the larger droplets bouncing off the leaf surface or shattering into smaller droplets that may not be recaptured when weed densities are low. Reduced retention of large droplets is often more pronounced on weeds that are hard to wet due to the types of wax structures in the cuticle of the leaf.

To compensate for the reduced number of droplets produced and for reduced retention of larger droplets, an increase in the total application volume (water rate, litre per hectare) is strongly recommended when moving from coarse to very coarse, extremely coarse or ultra coarse spray qualities.

When increasing the total application volume (L/ha), it is important to ensure that the water quality is suitable, that robust label rates are used and, where appropriate, additional adjuvants are used to maintain efficacy.

For many applicators, it may be initially worthwhile to use water-sensitive paper to assess potential spray coverage with various total application volumes in their own paddocks (for more information see the [GRDC GrowNotes™ on spray application – module 21 on assessing spray deposits](#)).

**Figure 1: Spray coverage on water-sensitive paper at three application volumes and various spray qualities.**



Source: sprayers101.com

## Key points

- Growers and spray operators need to check if their current nozzles meet the 2,4-D label application requirements
- Using very coarse or coarser spray qualities may require an increase in the total application volume to maintain efficacy
- To maintain efficacy when increasing the droplet size, operators must ensure that spray coverage on the target weeds is adequate, water quality is suitable and robust product label rates are used
- Always use robust rates according to label instructions

## Introduction

The Australian Pesticides and Veterinary Medicines Authority (APVMA) finalised the review of all 2,4-D labels in September 2020. This resulted in several amendments and changes to all labels relating to the herbicide's conditions of use including:

- a **mandatory** requirement to use nozzles producing droplets no smaller than very coarse spray quality;
- an **advisory** statement about spray application over summer to use extremely coarse (XC) to ultra coarse (UC) spray quality in sensitive areas;
- **DO NOT** spray when hazardous surface temperature inversion conditions exist;
- **DO NOT** apply if heavy rains or storms are forecast within three days, or if any rain is expected within six hours; and
- **DO NOT** apply in a manner that may cause an unacceptable impact to native vegetation, agricultural crops, landscaped gardens and aquaculture production, or cause contamination of plant or livestock commodities, outside the application site from spray drift.



## How much water is required?

When using a VC or XC spray quality with fully translocated products, such as those containing 2,4-D, a minimum application volume of 70L/ha is recommended in low stubble environments (typically less than 2.5 to 3.0 tonnes per hectare), increasing to at least 80L/ha as stubble loads increase. Good results for summer fallow weed control using 70L/ha XC spray quality have been achieved by spray operators.

Reductions in efficacy have been measured when using XC spray qualities at 50L/ha (compared with coarse), particularly when targeting hard-to-wet weeds in standing stubble.

When using a UC spray quality, total application volume should be at least 80L/ha and may need to be increased to 100L/ha or more in situations where there

are high weed densities or heavier stubble present. To identify suitable nozzle sizes to achieve higher total application volumes, see **Table 2**.

For example, from **Table 2** we can determine that an operator spraying at 25 kilometres per hour, who wants to achieve 80L/ha with a 50 centimetres nozzle spacing would require an O3 orifice at 6bar, or an O4 orifice at 3.5bar.

To provide applicators with a greater spray quality choice ranging from VC, XC to UC requires changing to high pressure air induction nozzles such as O3 or O4 Teejet TTI, TeeJet TTI60 or the Agrotop TurboDrop TD-XL-D with an operating pressure in the range of 4 to 6bar. To achieve a UC spray quality with these nozzles at a total application volume of 80L/ha requires a minor reduction in speed.

**Table 2: Total application volume (L/ha) at a range of spraying speeds (km/h) for common nozzle sizes based on a 50cm nozzle spacing.**

		L/ha at various speeds (km/h) based on a 50cm nozzle spacing																												
SIZE	BAR	L/min/ nozzle	8	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30						
015 GREEN	1.5	0.42	63	50	46	42	39	36	34	32	30	28	27	25	24	23	22	21	20	19	19	18	17	17						
	2.0	0.48	72	58	53	48	45	41	39	36	34	32	31	29	28	26	25	24	23	22	21	21	20	19						
	3.0	0.59	89	71	65	59	55	51	47	44	42	39	37	36	34	32	31	30	28	27	26	25	24	24						
	4.0	0.68	103	82	75	68	63	59	55	51	48	46	43	41	39	37	36	34	33	32	30	29	28	27						
	5.0	0.76	115	92	83	76	71	65	61	57	54	51	48	46	44	42	40	38	37	35	34	33	32	31						
	6.0	0.84	126	100	91	84	77	72	67	63	59	56	53	50	48	46	44	42	40	39	37	36	35	33						
	7.0	0.91	136	109	99	91	84	78	72	68	64	60	57	54	52	49	47	45	43	42	40	39	37	36						
	8.0	0.96	144	115	104	96	88	82	77	72	68	64	60	57	55	52	50	48	46	44	43	41	40	38						
02 YELLOW	1.5	0.56	84	67	61	56	52	48	45	42	39	37	35	33	32	30	29	28	27	26	25	24	23	22						
	2.0	0.65	97	77	70	65	60	55	52	48	46	43	41	39	37	35	34	32	31	30	29	28	27	26						
	3.0	0.79	119	95	86	79	73	68	63	59	56	53	50	47	45	43	41	40	38	36	35	34	33	32						
	4.0	0.91	137	109	100	91	84	78	73	68	64	61	58	55	52	50	48	46	44	42	41	39	38	36						
	5.0	1.02	153	122	111	102	94	87	82	76	72	68	64	61	58	56	53	51	49	47	45	44	42	41						
	6.0	1.12	168	134	122	112	103	96	89	84	79	74	71	67	64	61	58	56	54	52	50	48	46	45						
	7.0	1.21	181	145	132	121	111	103	96	90	85	80	76	72	69	66	63	60	58	56	54	52	50	48						
	8.0	1.29	193	155	141	129	119	110	103	97	91	86	81	77	74	70	67	64	62	59	57	55	53	52						
025 LILAC	1.5	0.70	105	84	76	70	64	60	56	52	49	47	44	42	40	38	36	35	34	32	31	30	29	28						
	2.0	0.81	121	97	88	81	74	69	64	60	57	54	51	48	46	44	42	40	39	37	36	35	33	32						
	3.0	0.99	148	118	108	99	91	85	79	74	70	66	62	59	56	54	51	49	47	46	44	42	41	39						
	4.0	1.14	171	137	124	114	105	98	91	86	80	76	72	68	65	62	59	57	55	53	51	49	47	46						
	5.0	1.27	191	153	139	127	118	109	102	96	90	85	80	76	73	69	66	64	61	59	57	55	53	51						
	6.0	1.40	209	168	152	140	129	120	112	105	99	93	88	84	80	76	73	70	67	64	62	60	58	56						
	7.0	1.51	226	181	165	151	139	129	121	113	106	101	95	90	86	82	79	75	72	70	67	65	62	60						
	8.0	1.61	242	193	176	161	149	138	129	121	114	107	102	97	92	88	84	81	77	74	72	69	67	64						
03 BLUE	1.5	0.84	126	100	91	84	77	72	67	63	59	56	53	50	48	46	44	42	40	39	37	36	35	33						
	2.0	0.97	145	116	105	97	89	83	77	73	68	64	61	58	55	53	50	48	46	45	43	41	40	39						
	3.0	1.18	178	142	129	118	109	101	95	89	84	79	75	71	68	65	62	59	57	55	53	51	49	47						
	4.0	1.37	205	164	149	137	126	117	109	103	96	91	86	82	78	75	71	68	66	63	61	59	57	55						
	5.0	1.53	229	183	167	153	141	131	122	115	108	102	97	92	87	83	80	76	73	71	68	66	63	61						
	6.0	1.68	251	201	183	168	155	144	134	126	118	112	106	101	96	91	87	84	80	77	74	72	69	67						
	7.0	1.81	271	217	197	181	167	155	145	136	128	121	114	109	103	99	94	90	87	83	80	78	75	72						
	8.0	1.93	290	232	211	193	179	166	155	145	137	129	122	116	111	105	101	97	93	89	86	83	80	77						
04 RED	1.5	1.12	168	134	122	112	103	96	89	84	79	74	71	67	64	61	58	56	54	52	50	48	46	45						
	2.0	1.29	193	155	141	129	119	110	103	97	91	86	81	77	74	70	67	64	62	59	57	55	53	52						
	3.0	1.58	237	189	172	158	146	135	126	118	111	105	100	95	90	86	82	79	76	73	70	68	65	63						
	4.0	1.82	273	219	199	182	168	156	146	137	129	122	115	109	104	99	95	91	88	84	81	78	75	73						
	5.0	2.04	306	245	222	204	188	175	163	153	144	136	129	122	117	111	106	102	98	94	91	87	84	82						
	6.0	2.23	335	268	244	223	206	191	179	167	158	149	141	134	128	122	117	112	107	103	99	96	92	89						
	7.0	2.41	362	289	263	241	223	207	193	181	170	161	152	145	138	132	126	121	116	111	107	103	100	96						
	8.0	2.58	387	309	281	258	238	221	206	193	182	172	163	155	147	141	135	129	124	119	115	111	107	103						

## FREQUENTLY ASKED QUESTIONS

### Will larger droplets result in poorer control?

Without increasing the total application volume, it is likely that a reduction in efficacy will occur, unless the operator is already using about 80L/ha or more.

### What spray quality do I use if I tank-mix 2,4-D with another product that requires a different spray quality?

Regardless of the tank-mix partner, 2,4-D must be applied according to the label instructions.

### Can I use the same nozzles used for 2,4-D for other products or double knocks?

Nozzles that produce VC or coarser spray qualities may also be suitable for other fully translocated products, including other Group 4 herbicides, glyphosate at higher application volumes and many soil-applied (pre-emergent) herbicides.

For contact herbicides, application volumes would need to be increased to more than 90L/ha when using VC or XC spray qualities. For UC, this may need to be well above 120 to 130L/ha. Therefore, double/second knocks with paraquat should continue to use a standard C spray quality when the wind direction is away from sensitive areas.

### If I am double-knocking, can I use less water in the first pass?

It is critical to maximise efficacy for every pass, even when a double knock is planned. Always use enough water to ensure good coverage in the first pass. This places less pressure on the product/s used in the second pass.

### How can I spray in a timely manner if I use more water and must fill the sprayer more often?

Increasing the total application volume will require more mixing and filling operations, which can eat into valuable spraying time. Having portable mixing and filling rigs, batching plants and water tankers allow the sprayer to be filled at the paddock, saving a lot of time. Modifications to the sprayer such as front fill points can also mean the sprayer does not have to be folded while filling occurs.

### Will increasing the water rate mean I will be spending more on adjuvants?

When adjuvants are added on a volume per volume basis, increasing the total application volume will mean a corresponding increase in adjuvant volume and a small increase in the overall cost per hectare. Ensuring water quality is good and using robust label rates of product can minimise additional adjuvant requirements. Always test water of unknown quality to determine if additional water conditioners are required.

## Pulse Width Modulation (PWM) systems

Examples of nozzles that can achieve VC, XC or UC spray quality at standard operating pressures include:

- ARAG TFLD 03 size and larger;
- Wilger DR-110 04 size and larger;
- Wilger DR-80 04 size and larger; and
- Wilger UR-110 04 size and larger only produces UC spray quality.

Some other nozzles may also be capable of producing these larger spray qualities at certain operating pressures and nozzle sizes. Refer to the GRDC PWM nozzles selection chart for additional information [grdc.com.au/PulseModulationNozzleSelectionGuide](http://grdc.com.au/PulseModulationNozzleSelectionGuide).

Note that adjusting the operating pressure of PWM systems will affect the 'duty cycle' (lower pressure increases duty cycle). It is important when using larger droplets (coarser spray qualities) that the 'duty cycle' be maintained as high as possible to avoid misses, as larger droplets will not redistribute in the same way smaller droplets will.

## Mixing and filling operations

Increasing total application volumes will result in an increase in the number of mixing and filling operations required. To minimise the time out of the paddock when spraying conditions are good, operators should consider where they can increase the efficiency of the mixing and filling operation. Equipment and practices that can increase efficiency include:

- portable batching plants and chemical trailers;
- water tankers and increasing the number of fill points around the farm;
- pre-treating water with water conditioners; and
- front fill points on sprayers to avoid folding the boom.

For more information see the **GRDC GrowNotes™ on Spray Application, module 9**, on mixing, filling and transfer systems.

## USEFUL RESOURCES

- **Spray Drift:** [grdc.com.au/resources-and-publications/resources/spray-drift](http://grdc.com.au/resources-and-publications/resources/spray-drift)
- **Hazardous Inversion Fact Sheet:** [grdc.com.au/resources-and-publications/all-publications/factsheets/2022/hazardous-inversion](http://grdc.com.au/resources-and-publications/all-publications/factsheets/2022/hazardous-inversion)
- **GRDC Spray Application GrowNotes™ Manual:** [grdc.com.au/resources-and-publications/grownotes/technical-manuals/spray-application-manual](http://grdc.com.au/resources-and-publications/grownotes/technical-manuals/spray-application-manual)
  - Refer to [Module 9 – Mixing, filling and transfer systems](#)
  - Refer to [Module 21 – Assessing spray deposits](#)
- **Bill Campbell Consulting, 0427 545 553, [bill@campbellag.com](mailto:bill@campbellag.com)**

**DISCLAIMER** Any recommendations, suggestions or opinions contained in this publication do not necessarily represent the policy or views of the Grains Research and Development Corporation. No person should act on the basis of the contents of this publication without first obtaining specific, independent, professional advice. The Corporation and contributors to this **Fact Sheet** may identify products by proprietary or trade names to help readers identify particular types of products. We do not endorse or recommend the products of any manufacturer referred to. Other products may perform as well as or better than those specifically referred to. GRDC will not be liable for any loss, damage, cost or expense incurred or arising by reason of any person using or relying on the information in this publication.

**CAUTION: RESEARCH ON UNREGISTERED AGRICULTURAL CHEMICAL USE** Any research with unregistered agricultural chemicals or of unregistered products reported in this document does not constitute a recommendation for that particular use by the authors or the authors' organisations. All agricultural chemical applications must accord with the currently registered label for that particular agricultural chemical, crop, pest and region.

Copyright © All material published in this **Fact Sheet** is copyright protected and may not be reproduced in any form without written permission from GRDC.