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SPRAY WATER QUALITY FACT SHEET

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NORTHERN, SOUTHERN AND WESTERN REGIONS

WATER QUALITY FOR SPRAYING OPERATIONS

KEY POINTS

- Poor water quality can adversely affect many products. Always consult product labels and the manufacturer's technical information about water quality requirements.
- Water testing should be done on a regular basis when using bore water, water from streams and rivers, reticulated (piped) water sourced from ground water, and water stored in unlined dams or concrete tanks.
- Water tests should analyse the following to be useful: pH, total hardness (including a measure of bi-carbonate levels) and total dissolved salts (TDS) or salinity (electrical conductivity).

Water quality test strips can be used to assess pH and water hardness in the field.
Source : Hach.com

Why test water quality?

The quality of the water used for spraying operations can be critical to ensuring the best spray results for many farm chemicals. Many products can be affected by poor water quality.

When considering if the water quality is suitable for a particular product, you need to have accurate information about what may be present in the water that could affect the products you intend using.

The starting point should always be an accurate water test from a reputable laboratory and a thorough check of the product label and technical information from the manufacturer.

What should tests measure?

Water tests for spraying operations should include:

- pH;
- total hardness;
- bicarbonate levels; and
- either total dissolved salts (TDS) or salinity (EC or electrical conductivity).

While pH levels and total hardness can be assessed in the field using water test strips or simple titrations (jar tests), other measurements will typically require laboratory analysis.

If using test strips it may be useful to compare laboratory results to test strip results by setting aside water collected for analysis to check the accuracy of the strips. The strips can then be used to assess if significant changes in water quality have occurred and when another laboratory test may be required.

Commonly available water test strips include those supplied by Hach Pty Ltd (ranging from simple pool test strips to more accurate individual test strips and titration kits) or individual pH and hardness test strips supplied by Rowe Scientific Pty Ltd.

Typically, these will be able to measure hardness or pH at varying levels of precision depending on the type of strips purchased. It is worth researching which may best suit your situation after receiving results from a laboratory.

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Collecting water samples for testing

Use a clean container of at least 500mL size.

Rinse the bottle a minimum of four times with the sample water (emptying it away from the sample site).

Collect the water (see Table 1).

Fill the bottle to the top, leaving little or no air space, and seal tightly.

Label the bottle accurately with where the sample was taken, the date and intended use.

Wrap the sample in aluminium foil to prevent UV light from degrading the sample.

Water pH

pH is a measure of the hydrogen ion concentration (H^+), which indicates how acidic or alkaline the water may be on a 1 to 14 scale, **where seven is considered neutral**. Values below seven are **acidic**, values above seven are **alkaline**.

Alkaline water (pH values typically above eight) can cause several problems. These include alkaline hydrolysis and increased dissociation (breakdown of the product), poor droplet contact with the target and reduced performance or stability from some formulations and adjuvants.

If considering reducing the pH of water to be used for spraying, a buffering agent or buffering surfactant will generally be simpler to use than straight acid. A buffering agent will reduce pH to a set point and hold it there, whereas straight acids tend to continue to reduce pH as you add more. Commercial adjuvants such as LI700 can reduce pH and have buffering capacity.

Acidic water (pH values typically below 4 to 5) can affect tank mix stability and lead to gelling of some salt-based products such as 2,4-D amines, particularly in tank mixes with some other salt-based and flowable products.

Water hardness

Total hardness is a measure of the amount of cations (positive ions) such as calcium, magnesium, sodium, iron and bicarbonates in the water, usually expressed in parts per million (ppm) or mg/L as calcium carbonate equivalents (e.g. $CaCO_3$ mg/L).

Cations such as calcium and magnesium in the water can bind with negatively charged products such as the weak acid herbicides (e.g. glyphosate), so that they lose their activity in the target plant.

Typically, water hardness above 250 to 350ppm ($CaCO_3$ equivalents) should be

Table 1 Sample timing and location

A new bore or well	*Sample after pumping for several hours*
An operating bore	*Sample after running the pump for 30 minutes, collect as close as possible to the head of the bore.*
A stream	*Sample main stream flow*
A dam or lake	*Sample away from the edge and near the suction inlet to the pump. Ensure water is well mixed and filtered, or sample various depths.*

Table 2 Herbicide tolerances to water qualities

Herbicide	Water quality				
	Muddy	Saline	Hard	Alkaline (> pH 8)	Acidic (< pH 5)
Affinity®	✓	✓	✓	X	NR
Ally®	✓	✓	✓	Marginal	X
Brodal®	✓	✓	X		
Dicamba	✓	✓	NR	NR	
Diuron	✓	Test	✓	✓	
Diuron + 2,4–D amine	✓	Test	X	NR	
Diuron + MCPA amine	✓	Test	X	NR	
Fusilade Forte	✓	✓	✓	NR	X
Glean®	✓	✓	✓	Marginal	X
Glyphosate	X	✓	X	✓	
Hoegrass®	✓	✓	✓	NR	✓
Logran®	✓	✓	✓	Marginal	X
Lontrel™	✓	✓	X	X	
Sertin®	✓	✓	✓	✓	✓
Simazine	✓	X	✓	NR	
Spray.Seed®	X	✓	✓	✓	✓
Targa®	✓	✓	✓	✓	✓
Tigre®	✓	X	X	NR	
Trifluralin	✓	✓	✓	✓	
Verdict®	✓	✓	✓	NR	✓
2,4–DB		X	NR		
2,4–D or MCPA amine	✓	✓	X	NR	
2,4–D or MCPA ester	✓	Test	Test	✓	✓

Key: ✓ = OK; X = Do not use; NR = Not recommended but use quickly if there is no alternative; Test = Mix herbicides and water in proportion and observe any instability; Marginal = Not ideal, but acceptable

Source: Weed Control in Winter Crops, 2011 – NSW DPI

treated before using seveal herbicides, particularly where pH is above seven. See Table 2 for examples of products affected by water quality.

Bicarbonates can also affect some products. Bicarbonate levels as low as 175ppm (mg/L) have been reported to reduce the efficacy of some Group A herbicides and 2,4-D amine. Often it is useful to have the level of bicarbonates identified as a separate measurement in a water quality test.

Ammonium sulfate (AMS) can assist with water hardness. Ammonium sulfate-based products (such as Liase® and Liquid Boost) that are registered as adjuvants may be used with a number of products to reduce the impact of water hardness.

Ammonium sulfate is most useful when supplied as a formulated liquid (typically around 417grams/L) or in a soluble

Table 3 Water hardness levels (WHL) and recommended treatment with AMS to alleviate the effects of hard water

Water hardness level Ca++ ppm	Water hardness level $CaCO_3$ ppm	Water hardness level	Syngenta Boost (AMS) recom-mend mL/100L
80	200	0.69	250
120	300	0.89	375
160	400	1.18	500
200	500	1.48	625
240	600	1.78	750
280	700	2.07	875
320	800	2.37	1000
360	900	2.66	1125
400	1000	2.96	1250
500	1250	3.70	1565
750	1875	5.55	2345
1000	2500	7.40	3125
Calcium	Calcium carbonate	1 WHL = 342 parts per million (ppm)*	

* testing kits are available in measurements of 342ppm or 1000ppm

Source: Syngenta Technotes TN08-379 Non-Selective Herbicides and Adjuvants

Table 4 Examples of products affected by water quality

Active/products	Hardness	Bicarbonates	Salinity	Muddiness	Alkalinity
Alpha Cypermethrin C (Fastac® Duo)					
Atrazine WG	Liase®				
Chlorsulfuron (Lusta®)	Liase®		Avoid		
Clethodim (Sequence®)		Liase®			
Clopyralid (Archer®)	Liase®				LI 700
Chlorpyrifos EC					LI 700
Cypermethrin EC					LI 700
Dicamba Amine (Kamba® M)	Liase®				LI 700
Diclofop-methyl (Nugrass®)					
Diflufenican (Agility®)					LI 700
Diflufenican/MCPA (Nugrex®)	Liase®				LI 700
Dimethoate					LI 700
Diquat/Paraquat (Revolver®)				Avoid	
Diuron	Liase®		Avoid		LI 700
Diuron + 2,4-D amine	Liase®	Avoid			LI 700
Diuron + MCPA amine(Agritone® 750)	Liase®		Avoid		LI 700
Glyphosate	Liase®			Avoid	LI 700
Roundup DST	Liase®			Avoid	LI 700
Glyphosate (Credit® + Bonus®)				Avoid	
Glyphosate (Roundup™ PowerMAX)	Liase®			Avoid	
Imazamox/Imazapyr (Intervix®)					
Imazamox (Raptor®)	Liase®				
MCPA amine	Liase®				LI 700
MCPA ester	Liase®		Avoid		
Phosmet (Imidan)	Liase®		Avoid		LI 700
Simazine 900 DF	Liase®		Avoid		
Tepraloxydim (Aramo®)		Liase®			
Tralkoxydim (Achieve®)		Liase®			
2,4–D ester (LV Estercide® Xtra)	Liase®		Avoid		
2,4–D amine (Surpass® 475)	Liase®	Avoid			LI 700

Chart legend: Managing water quality – recommendations depend on the severity of problem

Can be managed with Liase	Liase®	Generally no problem	
Can be managed with LI 700	LI 700	Water should be avoided	Avoid

Source : Nufarm Nozzle Charts 2009 and Nufarm Spraywise Spray Log

crystalline form (typically around 980gram/kg). These are often preferred by growers for their ease of mixing than the granular form.

Ammonium sulfate can assist in dealing with cations that may be present in the water, but by itself will not significantly change the pH, which may also need to be addressed at the same time to minimise issues such as alkaline hydrolysis and stability.

The amount of ammonium sulfate required can be calculated if a suitable water test is available. As a guide to appropriate amounts of ammonium sulfate to add to hard water, see Table 3.

Salinity (dissolved salts)

Salinity is usually measured as the electrical conductivity (EC) of the water.

High levels of salinity (above 1000ppm sodium chloride or ECs above 500-1000 microsiemens/cm) can result in some chemicals precipitating out of the solution and others being inactivated. It can also make it difficult to adjust pH using buffers.

Often the only solution with highly saline water is not to use it for spraying, or to greatly dilute it with clean rain water when it is available.

Dirty water (suspended solids)

Dirty or turbid water can adversely affect products such as Spray.Seed® and glyphosate due to the clay colloids suspended in the water. As a general rule, if a 10 cent coin cannot be seen in the bottom of a bucket of water it is too dirty for use with products affected by dirty water (see Table 4).

Filtering water and settling it in a holding tank prior to use can help to reduce turbidity. If using a settling agent, such as alum, only very small quantities should be used in accordance with the manufacturer's guidelines. Often too much alum is added to dam water, which can result in high levels of aluminum in solution. This increases hardness and creates more problems for several products than the untreated dirty water may have.

Temperature

Increased water temperatures can accelerate the breakdown of some products when the water quality is not suitable.

Low-temperature water can lead to solubility problems and gelling in the tank (even in clean water).

Summary

Poor water quality can adversely affect many spray jobs, particularly where products remain in the tank for extended periods, where high water rates are used, or where low rates of product are used.

Know what your water quality is and how to treat it when using different products.

FREQUENTLY ASKED QUESTIONS

Where can I get my water tested?

Check with your local department of agriculture or primary industries, or talk to your local chemical reseller about suitable laboratories in your state. Some chemical and adjuvant manufacturers also offer water testing through the reseller networks.

Where can I buy test strips?

Some of the basic test strips for pH and hardness are available in hardware stores or through stores that supply pool equipment. For more accurate test strips visit the manufacturer's websites to locate a local distributor (Hach.com or Rowe.com.au)

How often should I test my water?

If using bore water or water sourced from the ground, obtain a full laboratory test annually and not more than two years apart. If extending the interval between tests to two years, use test strips to check water quality in between. If a significant change in pH or hardness is noticed on the test strips get the water retested by a laboratory.

What should I do before mixing a spray load if I am not sure about the water quality?

Conduct a jar test to ensure the tank mix will be stable. For susceptible products use a robust rate of product and utilise an acidifying buffer/adjuvant and ammonium sulfate where appropriate.

USEFUL RESOURCES

Graham Betts, "Water Quality and Your Spray Product" in "Adjuvants: Oils, surfactants and other additives for farm chemicals", revised 2012 edition, GRDC and CFI.

T. Burfitt, S. Hardy and T. Somers, "Weed Control in Winter Crops, 2011" with extracts from Spray Sense Bulletin No.12, NSW DPI, 1996.

Gerard Bardell, "Water quality and spraying issues for 2007", BCG Crop and Pasture Production Manual 2006-2007.

John Moore, Vanessa Stewart & Jessica Johns, "Water quality for spraying", Department of Agriculture, Western Australia, e-weed, Edition 8, 5 June 2003.

MORE INFORMATION

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