

# SPRAY MIXING REQUIREMENTS FACT SHEET

## NORTHERN, SOUTHERN AND WESTERN REGIONS MIXING REQUIREMENTS FOR SPRAYING OPERATIONS

### KEY POINTS

- Understand what the formulation type is for each product and adjuvant being used.
- Never bring concentrated products into contact with each other through mixing equipment or in low tank volumes.
- Know the correct mixing order for every tank mix you use.



PHOTO: GRAHAM BETTS

Jar tests can be done in the paddock prior to mixing the chemicals. Chemicals can be measured using syringes, by substituting mL for L/ha and mixing in the same ratio and order as the actual tank mix.

### Importance of correct mixing order

Correct mixing order reduces the risk of products interacting in a way that may reduce their efficacy or affect the stability of the tank mix.

The addition of multiple products to the spray tank must take place in a specific

order to ensure they can be adequately mixed through the solution, according to their solubility and formulation type.

Bringing most products into contact with each other in a concentrated form will usually result in undesirable interactions between products.

Applicators must understand what the

formulation and adjuvant type is for each of the products they intend mixing.

Information about the correct mixing order can often be found on the product label. However, for some tank mix combinations, further information may be required from the manufacturer through tech notes or product guides.

Table 1 Formulation types and products		
Formulation type	Code	Example of products
Water dispersible granules and dry flowables	WDG	Spinnaker 700 WDG
	DF	Simazine 900 DF
	DF	Ally®
Suspension concentrates	SC	Gaucha® 600 Flowable
	SC	Regent® 200SC
	SC	Penncozeb® 420 SC
Emulsifiable concentrates	EC	Broadside®
	EC	Bromicide® 200
	EC	Invader® 600
	EC	TriflurX®
	EC	Fastac® Duo
Soluble liquids (which include soluble concentrates and aqueous concentrates)	SL	Amicide® 625
	SL	Kamba® M
	SL	Spray.Seed®
	SL	Surpass® 475
Soluble liquid (containing glyphosate)	SL	Roundup® Dual Salt Technology
	SL	Roundup Powermax®
	SL	Glyphosate CT

Table 2 Adjuvant types and products		
Adjuvant type	Types of products	Examples
Surfactants	Wetter 1000 products	Chemwett® 1000
	Organosilicones	Pulse®
	Stickers	Bond®
Oils	Petroleum-based oils	Uptake®
	Vegetable oils	Hasten®
Acidifiers and buffers	Acidifier/buffer	LI 700®
	Buffer	Primabuff®
Fertiliser adjuvants	Ammonium sulfate based	Liase®
		Boost®
		Liquid Ammo®

**Table 3 Basic chemical mixing guidelines**

Mixing order	Water – chemical – additives	Example of product
1	Water conditioners, acidifiers, etc.	e.g. Bonus <sup>®</sup> , Liase <sup>®</sup> , LI 700
2	Wettable, dispersible powders	e.g. Lusta <sup>®</sup> , Nugran <sup>®</sup> , Associate <sup>®</sup>
3	Dry flowable granules (WDG)	e.g. Diuron DF, Stimazine DF
4	Flowables (suspension concentrates)	e.g. Simazine, Diuron flowable
5	<sup>1</sup> Wetter if using ECs	e.g. Activator <sup>®</sup> 90, Chemwet 1000
6	Emulsifiable concentrate (EC)	e.g. Triflur <sup>®</sup> Xcel <sup>™</sup> , Avadex <sup>®</sup> Xtra, Estercide <sup>®</sup>
7	Water soluble concentrates	e.g. Amicide <sup>®</sup> , Credit <sup>®</sup> , Glyphosate CT, Amicide <sup>®</sup>
8	Adjuvants	e.g. Chemwet 1000 <sup>®</sup> , Oils <sup>2</sup> , LI 700 <sup>®3</sup>
9	Liquid UAN	Easy N

<sup>1</sup> Wetter to be added at stage 4 if using ECs

<sup>2</sup> Oils must be added last to all mixes

<sup>3</sup> If added at stage 1, do not add at stage 4 or 7

When adding water conditioner, fill spray tank as full as practical while adding water conditioner.

Add water conditioners before adding any chemicals.

There are some exceptions to these basic guidelines:

• Glyphosate and some 2,4–D products (such as, Surpass<sup>®</sup> 475 – see extract from the Surpass<sup>®</sup> 475 label):

1. Clean water
2. Add water conditioners
3. Add other herbicides, insecticides etc. Mix thoroughly
4. Add 2,4–D product
5. Fill the tank to around 95%
6. Add glyphosate
7. Add other adjuvants
8. Add remaining water

• Glyphosate and Starane<sup>™</sup> Advanced Herbicide. Refer to the Starane<sup>™</sup> Advanced label. Glyphosate is put in the spray tank before Starane<sup>™</sup> Advanced.

## Figure 1 Mixing instructions for Surpass<sup>®</sup> 475

Nufarm Surpass<sup>®</sup> 475 mixes readily with water. Ensure the spray tank is free of any residue of previous spray materials.

1. Fill the spray tank with clean water to one half of the required amount and start agitation. Mechanical agitation may cause excessive foaming when adding herbicides.
2. Bonus<sup>®</sup> or LI 700<sup>®</sup> is recommended at either 100mL or 300mL/100L, add to tank through top mesh screen.
3. Add recommended herbicide additive/insecticide to the spray tank and mix thoroughly.
4. Add Nufarm Surpass<sup>®</sup> and mix thoroughly.
5. Top up tank to 95% of desired capacity then add the glyphosate product and remaining water.
6. When Spraymate Activator<sup>®</sup> surfactant is used, add near the end of the filling process to minimise foaming.
7. Always maintain adequate agitation and use the mix promptly.

(Extract from the 2007 Nufarm Surpass<sup>®</sup> 475 label)

## Figure 2 A simple jar test

A guide to the suitability of water for spray applications can be quickly obtained using the following procedure.

1. Mix 500mL of correctly diluted spray in a clear glass sealed container according to the manufacturer's instructions.
2. Mix thoroughly and allow to stand for 30 minutes.
3. If creaming (where the spray or spray droplets tends to 'layer' at the top of the jar), sedimentation or separation into layers occurs, the water may be unsuitable for mixing sprays.
4. If suspected of being unsuitable, a sample of this water should be chemically analysed for salt and hardness levels.
5. Different brands of the same chemical may react differently because of different additives in each formulation.

## Knowledge of formulation types is essential for mixing

Formulation type is sometimes indicated on the product label if it is incorporated into the name of the product (for example, Nu-trazine 900DF for dry flowable, or Chlorpyrifos 500 EC for emulsifiable concentrate), but this is not always the case.

Examples of formulation types and products are shown in Table 1.

## Adjuvant types

The type of adjuvant is also important for determining the correct point during the mixing process that it should be added.

The addition of adjuvant to the tank mix

can change depending on the formulation of the products actually being mixed.

Examples of adjuvant types and products are shown in Table 2.

## Mixing order

Table 3 and Figure 1 include the suggested mixing orders for a range of situations.

## Jar tests to assess physical compatibility

If you are unsure about the ability to mix certain products it is always a good idea to contact the manufacturers for further information, and to conduct a jar test to confirm physical compatibility (see Figure 2).

A jar test can only tell you if the products are physically compatible (able to be mixed). It will not tell you if there are problems with biological compatibility, where one product may interfere with the biological activity of another.

## Summary

Mixing order is very important to ensure that tank mixed products perform to their potential.

Understanding formulation type and adjuvant type are an important part of getting the mixing order right.

If in doubt about the compatibility of products in a tank mix, contact the manufacturers and conduct a jar test to ensure they will mix.

## FREQUENTLY ASKED QUESTIONS:

### When should I add adjuvants?

That will depend on the adjuvant type. Water conditioners such as ammonium sulfate should be added to the recommended amount of water before other products are introduced into the tank. Surfactants like Wetter 1000 products are introduced at the end, unless liquid UAN is used which would go in after the wetter. If one of the products is an EC formulation the wetter would be added after the dry products, so always check the mixing order chart.

### Why do I get excessive foaming when I am mixing some products?

Often foaming results when using the Venturi system to fill the spray tank. Sometimes foaming can be reduced by having more water in the tank before introducing products or by using anti-foaming agents. Where these strategies do not work, it might require that filling be done using an external pump.

### How can I tell if products I have not used before can be mixed together?

Often there will be information about compatibility on the product labels. If specific information about the products you want to mix is not on the label, it is best to contact the manufacturer of the product before mixing takes place. If you are still in doubt, conduct a jar test which will let you know if they are physically compatible. Remember that even if they can be mixed, this will not tell you if they are biologically compatible.

### Why do some products 'gel' when mixed together?

Often this can result from a couple of factors interacting, which are water quality, mixing order and water temperature. Sometimes gelling can be accelerated if water is at a high temperature and water quality is not suitable. Other times gelling can occur with some products at low water temperatures. It is essential that water quality is considered as a part of the solution, and when using water conditioners that they be added to the water before mixing occurs. Then make sure the correct mixing order is followed.

## 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.

## MORE INFORMATION

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