

AVOIDING COMMON TANK MIXING ISSUES

TECH NOTE SERIES



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KEY POINTS

Tank mixing issues can be avoided by...

- Using correct mixing order
- Fill tank with 50% water before adding product
- Maintaining good agitation
- Using clean good quality water
- Jar testing if unsure of compatibility
- Being patient!
- Many tank mix issues are recoverable without dumping the mix!

Multiple tank mixes are becoming increasingly prevalent, particularly for pre-plant and early post emergent applications where getting across large areas in a timely manner is critical.

Unfortunately water is often not a great carrier for agricultural chemicals as it is a charged polar molecule and variability in water temperature and quality can affect how well products dissolve into it. When the cost of product in a spray tank is considered, it pays to ensure that they are mixed correctly.

Most agricultural chemicals are formulated to be as emulsifiable as possible, but many contain elements that either do not dissolve well (wetttable powders – WP's and water dispersible granules – WDG's), petroleum distillates (emulsifiable concentrates - EC's) or just precipitate, as they are heavier than the water (fertilizers, powdered metals, etc). Care should be taken when using these, particularly when under time constraints.

This technote describes correct mixing techniques to optimise active ingredient activity by maintaining them in suspension in the spray tank during the entire spray operation. Adjuvants and compatibilisers such as N-Flow® play a major role in bonding the otherwise unmixable spray materials with water.



Image 1: Modern spray equipment is designed for efficient coverage of large areas – however care should be taken with speed of tank filling and mixing (Source: SACOA)

COMMON MIXING ISSUES

Some of the more common mixing issues can be avoided simply in three ways:

1. Maintaining correct mixing order
2. Slowing down and filling with at least 50% water volume before adding product
3. Maintaining good agitation throughout the entire process

One of the most common causes of uneven application due to poor agitation lies with the spray applicator. Examples are:

- Not ensuring slow to dissolve formulations such as water dispersible granules (WDG) are in solution before adding more
- Dumping granules into water volumes that are too small, particularly granni pots
- Not agitating during mixing/loading
- Shutting down a sprayer with material in the tank when going on break or driving from paddock to paddock
- Not periodically inspecting the agitation systems (mechanical or hydraulic) to prevent failure, i.e. propeller wear, seal wear, nozzle wear, filter blockages, corrosion, etc.
- Not ensuring adequate cleanout, particularly of filters between jobs
- Attempting to mix in cold water
- Leaving a mixed solution in the spray tank overnight

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MULTIPLE COMPONENT TANK MIXING

Tank mixes with multiple components may overload the product specific surfactant systems and cause physical incompatibility. This can be observed as settling in the tank, thick paste residues on the tank bottom and filter blockages.

Incomplete dispersion or mixing will cause competition from components for the water to allow dissolution, dispersion and suspension to occur.

Incorrect order of addition and/or insufficient time between additions of each component means it is likely that product will settle in the tank. This settling will concentrate the active ingredients in the lower half of the tank. This may lead to filter blockages and also has the potential to cause both under and overdosing during the application. This will give either limited control of target species or setback the progress of the crop.

Tank mixes of dispersed insoluble actives (flowables and granules) can have physical incompatibility when mixed with EC's. Triazines can be a problem as there are big differences in quality and size of granules. If intending to use triazines in tank mix combination with other EC's, only use a quality triazine product.

Tank mixes of glyphosate and flowables/ granules may also be antagonistic without the use of water conditioning agents, such as Ammonium Sulphate or compatibilisers such as N-Flow®.

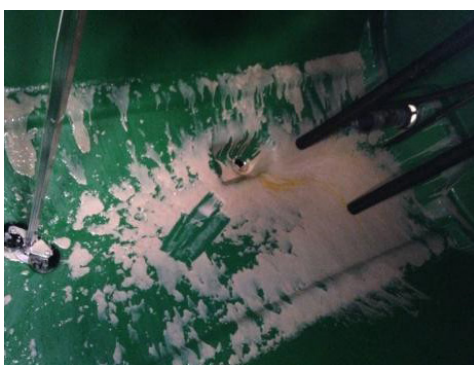


Image 2: Example of filter blockage and tank residues known as a reverse emulsion resulting from incorrect mixing procedure
(Source: SACOA)

UNDERSTANDING CHEMICAL FORMULATION

Products with low water solubility need to be added first!

Wettable Powders (WP's)

These are the slowest to dissolve as they have a very large surface area to be wetted and are often based on hydrophobic bases such as clays – hence they should be added first. Oils in particular reduce the mixing ability of wettable powders as they cause coating.

Water Dispersible Granules (WDG's) or Dry Flowables

These are similar to wettable powders in being difficult to dissolve. Due to their additional weight they tend to sink to the bottom of the tank – and hence require agitation to keep them suspended. Again contact with oils will reduce the ability to dissolve. Flowables – are a slurry of wetted particles and hence are still susceptible to non-mixing with oils or emulsifiable concentrates, particularly when added to low water volumes or cold water.

Soluble Liquids eg Emulsifiable Concentrates (EC's)

These consist of active ingredients already dissolved in water and therefore only require dilution in the spray tank.



PRECAUTIONS TO AVOID TROUBLE

- Use clean water (+10C) of low dissolved solids and hardness with neutral pH. Many active ingredients are most stable in neutral or acid solutions, some like paraquat are broken down by alkaline hydrolysis, whilst glyphosate performs best in a pH of 3.5 to 4.0. Acid to neutral water with a pH of 4.5 to 6.0 is ideal. COHORT® is an acidifying and penetrating surfactant that is designed to reduce alkaline hydrolysis of glyphosate whilst PLANTOCROP® and ENHANCE® are formulated to work in low temperature water.
- Use water-conditioning agents if water is of poor quality. Poor quality water has a high percentage of calcium and magnesium (water is classified as hard if it has >300ppm of Ca ions), a high proportion of dissolved salts (high EC) or has organic material in it making it cloudy. Ammonium Sulphate is useful for alleviating hard water and products like flocculants are useful for clarifying water.
- Make sure that spray equipment has good agitation, recirculation and replace old filters. Filters should be replaced annually, particularly if granule formulations have been used regularly.
- Batch mixers such as the Handler® reduce the risk of cross contamination, incorrect rate and incompatibility between different formulation types.
- Make sure of chemical mixing sequences and allow time between additions.



Image 3: Chemical batch mixer
(Source: SACOA)

- Allow sufficient time to ensure complete dispersion / suspension or dissolution of chemical into the water before next chemical addition or starting application.
- If in doubt, conduct a jar test to test for physical compatibility before making up tank mix. This will limit the chance of major problems.
- Problems occur when people are impatient and too eager to start application!

EFFECT OF CALCIUM ON GLYPHOSATE UPTAKE IN SETARIA (PIGEON GRASS)



Image 4: Glyphosate is inactivated in hard water
(Source: SACOA)

SUGGESTED MIXING ORDER

Each step should be separated by appropriate time and amounts of water.

1. Half fill the tank with agitation running.
2. With water still running into tank, add water conditioners / acidifiers if required.
3. For spray rigs that have a chemical induction hopper, three quarter fill the hopper with water and have the rinsing sprinkler operating. Add WP's and once dissolved, transfer this batch into the half-filled main tank.
4. Add WDG's as per step 3.
5. Continue agitation for at least 15 minutes and add flowable or suspension concentrates as per step 3.
6. Add wetter if using EC's.
7. Add EC's as per step 3.
8. Add more water to main tank until almost full.
9. Add water-soluble liquid concentrates (SLC) (eg Glyphosate 450®) as per step 3.
10. Add adjuvants – oils (ENHANCE®, ANTI-EVAP® or PLANTOCROP®) as per step 3.
11. Add liquid UAN.
12. Top up main spray tank to required water volume.
13. Maintain continuous agitation to ensure thorough mixing.
14. Do not mix more than is needed for the application.
15. Never leave a tank mix standing for long periods before use.



Image 5: Granni pot mixing intake
(Source: SACOA)

CHEMICAL MIXERS

Exercise caution when adding spray adjuvants (oils and wetters) to a tank mix through granulated product mixers (e.g. granni pots) by ensuring the water is vortexing (spinning) through the mixer. Chemical mixers are designed to help mix dry flowables and wettable granules. Care must be taken when using this equipment to add wetters and oils to a tank mix. Small amounts of water can be trapped behind the tap or in the plumbing, so when the tap is opened, this small amount of water mixes with the large amount of oil, which will overload the surfactant package and cause the oil to separate. Often a ricotta cheese like substance can be seen floating on top of the tank.

TANK MIX RECOVERY

If you have a problem, don't panic and dump the mix, as many events are recoverable. Be prepared to spend the time and effort to resolve the issue. It may require the addition of other products, such as N-Flow® or an additional surfactant such as WETTA1000® to assist recovery.

If product has started to settle in the tank and possibly block filters, then stop recirculation, remove filters and then resume recirculation at the fastest rate possible. If severe settling has occurred, it may be necessary to use a high volume pump like a fire fighter.

Manual agitation of the solids may be required to assist initial movement of material through the recirculation piping. For mixtures of dry flowable/ granules and water-soluble products, the addition of small amounts (200mls at a time) of extra surfactant, such as WETTA1000®, may be required to assist in the re-suspending process.

Once the products have been successfully re-suspended, apply with constant agitation.

Thoroughly clean out the tank after use and before a new mix is attempted. If extra help is required contact your reseller or chemical company representative.

Finally, as prevention is always better than a cure, if unsure of tank mix combination, perform a jar test. The mix should not be attempted if the following is observed;

- Settling
- Solid residues
- Separation of liquids, film on top of the liquids
- Heat generated
- Lumps
- Gels
- Poached eggs on top



Image 6: Example of filter blockage and tank residues known as a reverse emulsion resulting from incorrect mixing procedure (Source: SACOA)

REFERENCES

- GRDC Spray Water Quality Fact Sheet – August 2013
- GRDC Spray Mixing Requirements Fact Sheet – January 2013

FIND OUT MORE

Further information is available at www.sacoa.com.au or by contacting SACOA on 08 9386 7666 or contact your local SACOA representative;

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