What if less isn't more... just less effective?

Not all water conditioners are created equal.

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What's Really Happening in the Tank?

Cation-sensitive herbicides like glyphosate are easily compromised (complexed or bound) by minerals (cations) dissolved in spray water—especially **calcium, magnesium, sodium**, and **potassium**.

These cations interact with glyphosate's functional groups, **distorting the molecule** and forming inactive, poorly absorbed complexes.

The result? Weakened herbicide performance.

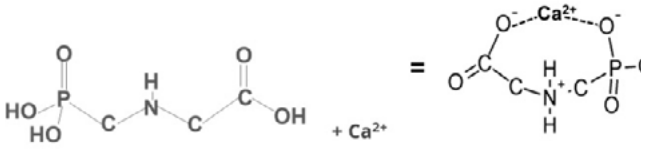
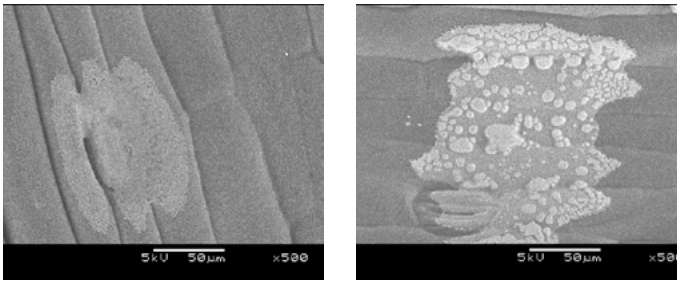


Figure 1: The distortion of the glyphosate molecule by a divalent cation like Ca^{2+}

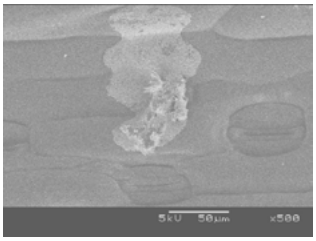


500× magnification of glyphosate spray droplet deposits. Left: distilled water. Right: calcium-containing water, where a crusty, viscous residue forms—hindering absorption. (Nalewaja, et al., 1996).

Here's where ammonium sulphate (AMS) comes in:

When AMS is included in the spray mix, the sulphate (SO_4^{2-}) binds to antagonistic cations **before** they can affect the glyphosate.

For example, sulphate binds calcium to form **insoluble gypsum ($CaSO_4$)** as the droplet dries. This leaves glyphosate **free and functional**, ready for absorption into the leaf. *Think calcium is bad? Just imagine what the others—magnesium, sodium, potassium—could do...*



In the presence of AMS, you'll spot gypsum's star-shaped crystals, a clear sign the calcium was neutralised before interfering with glyphosate.

LAB STUDIES SHOW:

59%

plant absorption of glyphosate dissolved in distilled water

21%

plant absorption of glyphosate dissolved in sodium-rich water

1%

plant absorption of glyphosate dissolved in calcium-rich water

We Put the Chemistry to the Test

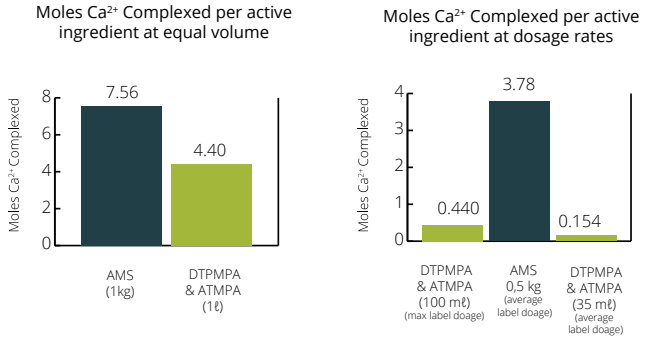
The first step in the chemical study was to determine the complexing ability of the replacement chemicals versus ammonium sulphate.

Adjuvant	Moles Ca^{2+} Complexed
Ammonium sulphate	**7.56 per kg**
DTPMPA* + ATMPA** (3:1) 500g/litre solution	4.40 per L
Phosphoric acid (1:1 DCP:MCP)	6.55 per L
Nitro carbohydrate complex	0.79 per L

Table 1: Calculated complexing ability of water conditioners at similar rates in hard water.

**Diethylene Triamine Penta (Methylene Phosphonic Acid)*
***Amino Tris (Methylene Phosphonic Acid)*

1 kg of **AMS** complexes **7.56 moles** of calcium, while 1 litre of **DTPMPA + ATMPA** manages only **4.40 moles (under ideal conditions).**



Even at **half a kilogram** (the average AMS dosage), you still get **3.78 moles** of calcium binding—far above what **DTPMPA + ATMPA** delivers at either **100 ml (0.44 moles)** or **35 ml (0.15 moles).**

To get the same complexing power as AMS, the alternative would need to be applied at more than **17×** its maximum label rate. That's not just inefficient—it's uneconomical.

Furthermore, replacement adjuvants often work by chelating, not precipitating. That's a big difference.

- **Chelation is reversible.** The calcium stays in solution and can still re-enter the solution and antagonise glyphosate.
- **AMS precipitation is permanent.** Once the calcium is bound, it's out of the equation—for good.

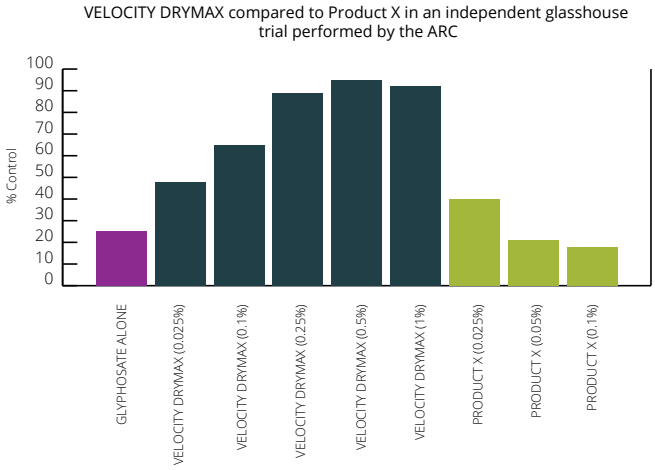
And since many of these replacements use similar functional groups to glyphosate, they **compete** for the same cations, making things worse—not better.

Glasshouse Trials: The Controlled Comparison

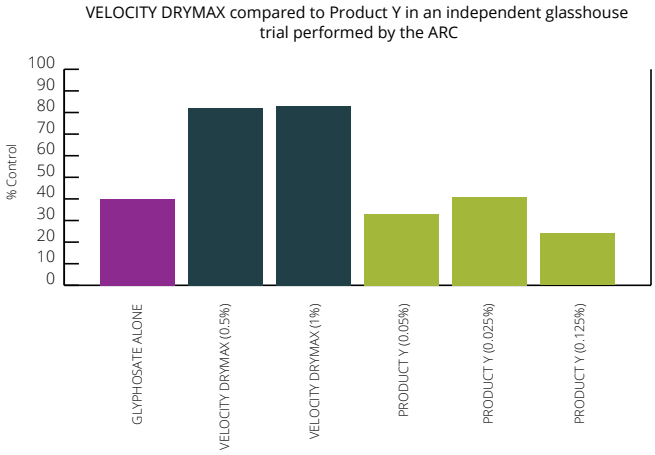
In Trial 1, we compared:

- VELOCITY-DRYMAX at both standard and low rates
- A replacement product ("Product X")
- All with the same calcium-rich water
- Glyphosate alone as control

In Trial 2, we repeated the setup with a second replacement ("Product Y")



Trial 1: Efficacy of glyphosate in calcium-containing water when applied with ammonium sulphate and replacement Product X.



Trial 2: Efficacy of glyphosate in calcium-containing water when applied with ammonium sulphate and replacement product Product Y.

WHAT WE FOUND:

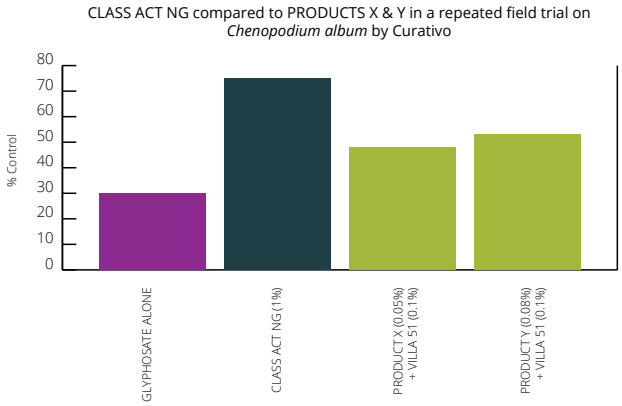
Glyphosate on its own performed poorly—by design, to reveal the impact of the adjuvant. Only the ammonium sulphate product (VELOCITY-DRYMAX) consistently enhanced herbicide efficacy. Even when used at the same low rates as the replacements, it still outperformed them.

Field Trial:
Putting It to Work Where It Matters

In the real world, we tested **CLASS ACT® NG** against both Product X and Y, again using calcium-rich water. To level the playing field, we added 0.1% **VILLA 51** (a surfactant) to the replacement products—since **CLASS ACT® NG** already includes one.

Result: Despite the equal surfactant conditions, only CLASS ACT® NG delivered reliable, consistent weed control.

Trial 3: Efficacy of glyphosate in calcium-containing water when applied with CLASS ACT® NG and Products X & Y.



The only AMS adjuvants Villa endorses for glyphosate and other cation-sensitive herbicides:

ADJUVANT **Class Act® NG**

- Premium spray-grade ammonium sulphate + surfactant + humectant + defoamer
- Ensures optimal glyphosate uptake, even in clean water
- Easy to use, efficient, consistent

Adjuvant **VELOCITY® DRYMAX**

- Granular format, easy handling
- Contains ammonium sulphate for full ion complexation
- Cost-effective transport and excellent field performance

BONUS:
Overcomes antagonism of phenoxy herbicides on glyphosate too.

THE TAKEAWAY:

- Replacements failed to match AMS even under ideal conditions.
- VELOCITY DRYMAX was effective in glasshouse trials—even at lower rates than recommended.
- CLASS ACT® NG, with its built-in surfactant system, consistently outperformed the alternatives under field conditions.
- AMS and AMS-containing products gave better, cleaner, more complete control in both science and practice.

Science doesn't lie. AMS still wins.

Scan to read the full article by Dr. Brian de Villiers and Dr. Johan Huyser.

Works Cited
Nalewaja, J., De Villiers, B. & Matysiak, R., 1996. Surfactant and salt affect glyphosate retention and absorption. Weed Research, June.pp. 241-247.