Managing Glyphosate.

Performance of different salts and adjuvants

Today’s presenters are

Mark Congreve (ICAN) and Andrew Somervaille (Jubilee Consulting)

Facilitated by Mark Congreve and Georgia Rose (ICAN)

This Webinar will start at the following times
8.30 AM (NSW/VIC/TAS/QLD)
Housekeeping

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• We are using chat box for questions, audio questions are muted to maximise sound quality. Questions will be relayed by the moderator.
• Questions (except for clarification) will be left until the end of the presentation and repeated by the moderator.
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Moderator: Georgia Rose
GRDC Project code ICN00016
Despite emerging glyphosate resistance, glyphosate remains critical to northern farming systems.

Maximising performance, and hence maximising weed control, is a key step to delaying herbicide resistance.

The optimum performance of glyphosate is driven by the interaction between glyphosate, surfactants, environment, weeds and application.
Webinar agenda

• Different glyphosate salt formulations
• Adjuvant systems
  – In-can
  – Tank mixes
• Water quality
• Tank mix incompatibility
Glyphosate acid is what kills weeds.

Why do we apply glyphosate as a ‘salt’ formulation?

What different ‘salt’ formulations are available?

How do these formulations differ?
Glyphosate ‘salt’ formulations

• Limited water solubility of glyphosate acid (12 g/L) requires it to be generally formulated as a monoanionic salt to assist leaf penetration.

• Solubility also determines active loading of formulation

• Once inside the leaf, glyphosate ‘salts’ readily convert to glyphosate acid.
## Glyphosate ‘salt’ formulations

<table>
<thead>
<tr>
<th>Salt formulation</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isopropylamine</td>
<td>e.g. Roundup® CT, Roundup Biactive®</td>
</tr>
<tr>
<td>Dimethylamine</td>
<td>e.g. Ripper® 480 Flexi</td>
</tr>
<tr>
<td>Mono-ammonium</td>
<td>e.g. Roundup Ready Plantshield®</td>
</tr>
<tr>
<td>Monoethanolamine</td>
<td></td>
</tr>
<tr>
<td>Potassium</td>
<td>e.g. Roundup Ultramax®</td>
</tr>
<tr>
<td>Sodium</td>
<td></td>
</tr>
<tr>
<td>Ammonium plus isopropylamine</td>
<td>e.g. Weedmaster Duo®</td>
</tr>
<tr>
<td>Monotrimethylsulfonium (TMS)</td>
<td></td>
</tr>
<tr>
<td>Ammonium plus potassium</td>
<td>e.g. Weedmaster DST®</td>
</tr>
<tr>
<td>Potassium plus isopropylamine</td>
<td>e.g. Weedmaster Argo®</td>
</tr>
</tbody>
</table>
## Solubility of various salts

<table>
<thead>
<tr>
<th>Salt</th>
<th>Solubility (g/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glyphosate acid</td>
<td>12</td>
</tr>
<tr>
<td>Calcium</td>
<td>30</td>
</tr>
<tr>
<td>Ammonium</td>
<td>300</td>
</tr>
<tr>
<td>Isopropylamine (IPA)</td>
<td>500</td>
</tr>
<tr>
<td>Sodium</td>
<td>500</td>
</tr>
<tr>
<td>Potassium</td>
<td>900</td>
</tr>
</tbody>
</table>
Does formulation effect weed control?
Does formulation effect weed control?

• Differences of effectiveness reflect efficiency of other formulation components, specifically adjuvant systems

• Main surfactant types used with glyphosate:
  – Alkylamine and alkyletheramine e.g. Tallow-amine
  – Quaternary amine
  – Alkyl betaine (amphoteric)
  – Alkyl polyglycoside (Touchdown Hi-tech®)
  – Alcohol ethoxylates
  – Alcohol ethoxylate phosphate esters
  – blends
Surfactant-weed specific responses

• Effects masked at increasing application rates
• Effects may vary with growing conditions; interaction with other adjuvants etc.
• Certain weeds appear to be more responsive to specific surfactants
  – e.g. Tallowamine ethoxylate to awnless barnyard grass, sowthistle
• Some surfactants produce inferior results on certain grasses
  – e.g. Alkyl betaines not so effective against awnless barnyard grass
Are there any rules of thumb to understand what surfactant type has been used in my formulation?
Water Quality & Quantity

- Suspended clay & organic matter
- Water pH
- Water volume
- Hardness
Water Hardness

• Iron, calcium and magnesium ions responsible for reduced performance in “hard” water
• Sodium at high levels can also be antagonistic
• Various compounds can reverse impact of hard water including ammonium sulphate, sulfuric acid, oxalic acid, citric acid and EDTA
Hard water effects on grass weed control

Nufarm Australia. Location Edgeroi, NSW. 33 DAA

- Soft water
- Hard water (1000ppm)

Control of grass weeds

- Roundup DST
- Roundup DST + Liase
Ammonium sulphate calculator

Kg /100 L =

0.001 x Ca (ppm) +
0.0006 x Na +
0.0002 x K +
0.0017 x Mg
Environmental stress affects:
- plant metabolism
- plant water potential (solute concentration)
- plant phenology (leaf shape, orientation)
Uptake and moisture stress

- Glyphosate uptake driven by concentration gradient
- Reduced plant growth results in reduced translocation
- Herbicide induced damage to herbicide “sinks” mean that uptake can become “self limiting” as herbicide begins to affect plant function

- Weeds particularly susceptible to moisture stress
  - Button grass
  - Liverseed (Urochloa) grass
  - Awnless barnyard grass
  - Red pigweed
Heat stress

• Occurs when day maxima consistently exceeds 36°C, even if soil moisture adequate

• Cannot be overcome by spraying in the cool of the day

• Strategy should be to treat prior to, or early in the sequence of “hot” days, or delay until day maximum drops to 36°C or below.
Tank mix compatibilities

What combinations of herbicides and/or adjuvants need to be watched?
Oil based adjuvants and glyphosate

• Oil based adjuvants normally optimise:
  – Group A herbicides for grass weeds
  – Group G (e.g. Valor®, Sharpen®) in fallow
  – Group I (e.g. 2,4-D, triclopyr) for melons

• Activity of glyphosate on certain grasses (e.g. awnless barnyard grass) may be reduced with inclusion of these adjuvants.
  – Use adjuvants optimal for partner herbicide
  – Keep glyphosate rates high
Other potential antagonism

• Antagonism may occur with:
  – Group C – Atrazine, simazine, terbuthylazine, diuron, prometryn (especially barnyard grass)
  – Group I – 2,4-D (sow thistle), dicamba, fluroxypyr
  – Group G – Oxyfluorfen, carfentrazone, flumioxazin, saflufenacil (particularly under high light intensity)
Thanks to Andrew Somervaille (Jubilee Consulting) who has provided his expertise and made data available to assist ICAN in delivering this webinar as part of GRDC northern region Integrated Weed Management extension training (project code ICN00016).