Spray Adjuvants

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Adjuvants can be extremely confusing

• Dozens of manufactures
  – Dozens of different product names
• Dozens of types
  – What do I use when?
• Make a large difference in effectiveness
• Many claim very lofty results
  – Allows reduced rates, reduces regrowth, etc.
• **Adjuvant** is any substance that has no pesticidal activity applied alone but when added to the formulation or the spray tank can improve pesticidal activity or application characteristics.
Adjuvants

• What do they do?
  – Improve weed control

• Why do we use them?
  –$$$$$$$
Why use surfactants?
2 classes of adjuvants

• Activators
  – Improve performance

• Utility
  – Improve ease of application
## 2 classes of adjuvants

### Activators
- Wetter-spreader
  - Non-ionic surfactant
  - Silicone surfactant
- Penetrate
  - Crop oils
  - Basal oils
- Sticker

### Utility
- Compatibility agent
- Defoamer
- Anti-drift
- Water Conditioner
- pH modifiers
- Polymers
Activators
Wetter-Spreader

- Flattens out the spray drop
  - Leaves are covered with wax
  - Wax repels water
  - Surfactants overcome the repulsion

- Reduces bounce

- These are non-ionic surfactants
Reduction of Droplet Surface Tension

Leaf Surface

No Surfactant

Surfactant
Sticker

• Improves retention of chemical on leaf
• May reduce wash-off from rain

But

• Most liquid formulations contain these
• Good for WP formulations
  – Few herbicides are WP formulations
  – A NIS will also act like a sticker
Penetrants

• Improve herbicide uptake by driving the herbicide into the leaf
• Actually dissolve the waxes on the leaf

• These are oil based adjuvants
  – Crop oils and MSO
  – Crop oil also has spreader activity (they contain 5 – 20% surfactant)
  – Crop oils increase injury
Utility adjuvants
Compatibility Agent

• Ensures a uniform spray mixture
• Non-compatibility is most common with low spray volumes
Compatibility Agent

- Ensures a uniform spray mixture
- Non-compatibility is most common with low spray volumes

- Increase carrier volume
- Use high quality surfactants
- If you are not having compatibility problems, you probably don’t need these.
Defoamer

- Eliminates foam when refilling tanks
- Everyone needs a bottle of this!
  - Especially when spraying glyphosate
- A little goes a long way
Water Conditioner

• Necessary if dealing with hard water
• Particularly beneficial with glyphosate
• Most useful is ammonium sulfate
Most herbicides are salts (have positive and negative parts)

Glyphosate

Triclopyr 3A
If mineral content is high...
If mineral content is high...

Glyphosate

\[ \text{HO-} \overset{\text{C}}{\text{-}} \overset{\text{C-N-C-P-O}}{\text{-}} \overset{\text{O}}{\text{H}_2 \text{H}_2 \text{H}} + \text{Mg}^+ \]

\[ +\text{H}_3\text{N-CH} \text{CH}_3 \]

\[ +\text{H}_3\text{N-CH} \text{CH}_3 \]
Water Conditioner

- Particularly beneficial with glyphosate
- Most useful is ammonium sulfate
  - Application rate is 7 to 17 lb/100 gal
  - Use liquid or spray grade AMS
  - Must be added to tank before herbicide!!

- Can speed up herbicide action
- Can be corrosive to sprayer parts
Anti-Drift agents

- These are generally polymers
- Increase shear strength of the water
- This forces the droplets to become larger, larger droplets don’t drift as easily

**But**

- Can turn spray solution into “goop”
- Tip clogging is common
Reducing drift

1. Spray closer to target.

2. Lower spray pressure
   • Lower pressure means larger droplets
pH modifiers

- Persistence in water
  - Some herbicides can be degrade in water
- Solubility in water
  - Increase solubility can increase activity

But

- These problems are largely theoretical
  - Don’t leave spray in tank for >12h
  - Unless water pH is >8, may not be needed
What Brand of NIS is best?

• I use many brands interchangeably
• Anything with >80% active ingredient will generally be fine.

• But don’t routinely buy the cheapest
• The most expensive is not always the best
What rate of NIS is best?

- As a rule of thumb, I use 1 qt/100 gal (0.25% v/v)
- Sometime you see labels for 0.5% v/v
  - Above this does no good.
What about crop-oil?

• Again, most brands will work fine.
• Rate: 1% v/v or 1 qt/acre – you choose.

• Since COC dissolves leaf waxes, high rates can burn plant leaves.
  – NIS does not burn leaves
What about diesel fuel?

- Diesel is a oil and oils dissolve leaf waxes
- Diesel was not designed to be a spray adjuvant
- It removes too much leaf wax and damages the leaf
- Unhealthy leaves to not promote herbicide activity.
What about dish detergent?

• Again, not designed to be an adjuvant
• Excessive foaming
• HIGH cost

• A proper spray adjuvant is cheaper and has a proven track record
Conclusions

• Surfactants make a big difference – regardless of brand
• Ammonium sulfate can enhance glyphosate if you have hard water
• Defoamer can save you a lot of frustration
Beware of these!

• Adjuvants that claim:
  – Equal control at reduced herbicide rates
  – Products that “reduce regrowth”
  – Cocktails (spreader + sticker + compatibility + etc). These are usually more costly and give little benefit.
  – *Anything that sounds too good to be true*
Lastly

• Stick with what you know
• If you are satisfied with the product you are currently using, don’t change.
• If glyphosate is working fine, don’t add ammonium sulfate. If it is inconsistent, consider using ammonium sulfate.