5. NOTES ON ADJUVANTS

Introduction

An adjuvant is any substance added to a spray solution to modify and enhance the effectiveness of the herbicide.

Adjuvants are an important part of the spray solution and if not used will negatively affect the degree of weed control obtained. Some products have adjuvants formulated into the product while other products require that the user add the adjuvant. The selection of adjuvants is key to obtaining the right balance between maximizing weed control and minimizing crop injury. In some cases the rate of adjuvant varies depending on conditions of weather, crop stage, weed species, water quality, etc. Some herbicide labels recommend particular adjuvant products and some recommend particular types of adjuvants. Always use adjuvants as directed on the product label.

Most adjuvants referred to in this guide are listed as the amount (in litres) added to 1,000 L (L/1,000 L) of spray solution. If you wish to convert to % volume/volume (v/v) use the following conversion:

10 L/1,000 L = 1% v/v

There are 2 broad categories of adjuvants:

- activators and spray modifiers, and
- utility modifiers.

Activators and Spray Modifiers

- **Surfactants** (also known as “surface active agents”) are the largest class of adjuvants. Surfactants can be non-ionic, anionic, cationic or amphuteric. Most surfactants are non-ionic (NIS); that is they do not ionize. A NIS is used to enhance herbicide penetration into a waxy cuticle. Wetting agents and detergents are primarily anionic and when ionized in solution, the water soluble portion is negatively charged. Cationic surfactants exhibit a net positive charge in solution. Amphuteric surfactants can be either anionic or cationic. Cationic and amphuteric surfactants are not widely used in agricultural chemicals.

- **Oils** solubilize the waxy cuticle layer on a weed leaf surface to increase spray penetration through the leaf cuticle. Oils are refined mineral oils (petroleum based) or seed oils. Seed oils are categorized as triglycerides, methylated seed oils (MSO) or crop oil concentrates (COC). Crop oil concentrates are a combination of seed oil and surfactants.

Utility Modifiers

- **Compatibility** agents improve mixing, especially when using a liquid fertilizer carrier.

- **Drift control** agents increase the droplet size to reduce drift.

- **Anti-foaming/Defoaming** agents are used to reduce and prevent foaming in the spray tank.

- **Foaming** agents are used with specialized equipment to produce and apply foam.

- **Buffering** agents can be used to enhance solubility or adjust pH.

- **Dyes are used** in some instances to enhance visibility of spray foam solutions.

Note

Complete information on each adjuvant is available on the product label which is located on the product container. The federal Pest Management Regulatory Agency also lists pesticide labels on their website.

Many pesticide manufacturers also list product labels and/or Material Safety Data Sheets (MSDS) on their websites.
### TABLE 5–1. Adjuvants Used in Ontario

**LEGEND:** N/A = not applicable. These types of products are not required to be classified under the *Pesticide Control Product Act* (PCPA).

<table>
<thead>
<tr>
<th>Trade Names$^1$</th>
<th>Registration (PCP) Number$^2$</th>
<th>Chemical Composition</th>
<th>Concentration</th>
<th>Ontario Class$^3$</th>
<th>Manufacturer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-Ionic Surfactants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGRAL 90</td>
<td>11809</td>
<td>nonylphenoxy polyethoxyethanol</td>
<td>90%</td>
<td>3</td>
<td>Syngenta Canada Inc.</td>
</tr>
<tr>
<td>AGRAL 90</td>
<td>24725</td>
<td>nonylphenoxy polyethoxyethanol</td>
<td>90%</td>
<td>3</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>CITOWETT PLUS</td>
<td>12766</td>
<td>octylphenoxy-polyethoxy ethanol</td>
<td>50%</td>
<td>4</td>
<td>BASF Canada Inc.</td>
</tr>
<tr>
<td>CONTACT</td>
<td>28326</td>
<td>alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol</td>
<td>900 g/L</td>
<td>4</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>COMPANION</td>
<td>15882</td>
<td>octylphenoxy-polyethoxy-(9) ethanol</td>
<td>70%</td>
<td>4</td>
<td>Corteva</td>
</tr>
<tr>
<td>DYNAMAX ADJUVANT</td>
<td>31814</td>
<td>triglyceride ethoxylate; siloxylated polyether</td>
<td>56% + 24%</td>
<td>3</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>ENHANCE</td>
<td>29270</td>
<td>triglyceride ethoxylate</td>
<td>80%</td>
<td>4</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>HIACITIVTE</td>
<td>31817</td>
<td>alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol</td>
<td>900 g/L</td>
<td>-</td>
<td>Windfield Solutions</td>
</tr>
<tr>
<td>ICON</td>
<td>28342</td>
<td>nonylphenoxy polyethoxyethanol</td>
<td>90%</td>
<td>4</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>INDEX</td>
<td>28181</td>
<td>alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol</td>
<td>900 g/L</td>
<td>4</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>IPCO AG-SURF</td>
<td>15881</td>
<td>nonylphenoxy polyethoxyethanol</td>
<td>92%</td>
<td>3</td>
<td>Interprovincial Coop</td>
</tr>
<tr>
<td>LI700</td>
<td>23026</td>
<td>phosphatidylcholine, methylacetic acid, alky polyoxyethylene ether</td>
<td>80%</td>
<td>4</td>
<td>Loveland Products</td>
</tr>
<tr>
<td>LIBERATE</td>
<td>29491</td>
<td>lecithin, methyl esters of fatty acids and alcohol ethoxylate</td>
<td>100 g/L</td>
<td>3</td>
<td>Loveland Products</td>
</tr>
<tr>
<td>LINK</td>
<td>28291</td>
<td>alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol</td>
<td>900 g/L</td>
<td>4</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>NUUAFM AG-SURF</td>
<td>27921</td>
<td>nonylphenoxy polyethoxyethanol</td>
<td>92%</td>
<td>4</td>
<td>NuFarm Canada</td>
</tr>
<tr>
<td>PRO-SURF II</td>
<td>28327</td>
<td>alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol</td>
<td>900 g/L</td>
<td>4</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>SENTRY</td>
<td>28343</td>
<td>nonylphenoxy polyethoxyethanol</td>
<td>90%</td>
<td>4</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>SIDEKICK II</td>
<td>28914</td>
<td>alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol</td>
<td>900 g/L</td>
<td>4</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>SUFFIX</td>
<td>28184</td>
<td>nonylphenoxy polyethoxyethanol</td>
<td>90%</td>
<td>4</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>SUPER SPREADER</td>
<td>17402</td>
<td>octylphenoxy-polyethoxy ethanol</td>
<td>50%</td>
<td>4</td>
<td>Loveland Products</td>
</tr>
<tr>
<td>WEEDAWAY AG SURF</td>
<td>22881</td>
<td>nonylphenoxy polyethoxyethanol</td>
<td>92%</td>
<td>3</td>
<td>Interprovincial Coop</td>
</tr>
</tbody>
</table>

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**LEGEND:** N/A = not applicable. These types of products are not required to be classified under the *Pesticide Control Product Act* (PCPA).

<table>
<thead>
<tr>
<th>Trade Names¹</th>
<th>Registration (PCP) Number²</th>
<th>Chemical Composition</th>
<th>Concentration</th>
<th>Ontario Class³</th>
<th>Manufacturer/Agent Code⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solvents (Oils)/Surfactants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADDIT ADJUVANT</td>
<td>29263</td>
<td>surfactant</td>
<td>36.9%</td>
<td>4</td>
<td>Adama Canada</td>
</tr>
<tr>
<td>AMIGO</td>
<td>22644</td>
<td>phosphate ester surfactant</td>
<td>30%</td>
<td>2</td>
<td>Arysta LifeScience</td>
</tr>
<tr>
<td>ASSIST OIL CONCENTRATE</td>
<td>16937</td>
<td>paraffin base mineral oil + surfactant blend</td>
<td>83% + 17%</td>
<td>4</td>
<td>BASF Canada Inc.</td>
</tr>
<tr>
<td>CARRIER</td>
<td>30639</td>
<td>mineral oil + surfactant blend</td>
<td>50% + 40%</td>
<td>4</td>
<td>NuFarm Canada</td>
</tr>
<tr>
<td>CONTENDER MSO</td>
<td>32198</td>
<td>methylated seed oil of soybean</td>
<td>70%</td>
<td>4</td>
<td>Interprovincial Coop</td>
</tr>
<tr>
<td>HASTEN NT ULTRA</td>
<td>31760</td>
<td>methyl and ethyl olate</td>
<td>75.2%</td>
<td>4</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>MERGE</td>
<td>24702</td>
<td>surfactant blend + solvent (petroleum hydrocarbons)</td>
<td>50% + 50%</td>
<td>4</td>
<td>BASF Canada Inc.</td>
</tr>
<tr>
<td>MERGE1</td>
<td>21058</td>
<td>surfactant blend + solvent (petroleum hydrocarbons)</td>
<td>50% + 50%</td>
<td>4</td>
<td>BASF Canada Inc.</td>
</tr>
<tr>
<td>MSO CONCENTRATE</td>
<td>28385</td>
<td>methylated seed oil of soybean</td>
<td>70%</td>
<td>4</td>
<td>Loveland Products</td>
</tr>
<tr>
<td>SURE-MIX</td>
<td>25467</td>
<td>paraffin petroleum oil + surfactant blend</td>
<td>60% + 35.6%</td>
<td>4</td>
<td>AMVAC Canada</td>
</tr>
<tr>
<td>TURBOCHARGE</td>
<td>23135</td>
<td>paraffin base mineral oil + surfactant blend</td>
<td>50% + 39.5%</td>
<td>4</td>
<td>Syngenta Canada Inc.</td>
</tr>
<tr>
<td>X-ACT</td>
<td>28225</td>
<td>phosphate ester surfactant</td>
<td>30%</td>
<td>2</td>
<td>Adama Canada</td>
</tr>
<tr>
<td>XA OIL CONCENTRATE</td>
<td>11769</td>
<td>paraffin base mineral oil + surfactant blend</td>
<td>83% + 17%</td>
<td>4</td>
<td>Loveland Products</td>
</tr>
<tr>
<td>XIAMETER OFX-0309</td>
<td>23078</td>
<td>silicone polyether + surfactant blend</td>
<td>76% + 24%</td>
<td>4</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td><strong>Compatiblility Agents</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALLIANCE</td>
<td>N/A</td>
<td>aliphatic phosphate ester, isopropanol and glycol ethers</td>
<td>69%</td>
<td>N/A</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>UNITE</td>
<td>N/A</td>
<td>acid polyglycols and methyl alcohol</td>
<td>83.70%</td>
<td>N/A</td>
<td>Loveland Products</td>
</tr>
<tr>
<td><strong>Water Buffering Agents</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AQUA-STABLE</td>
<td>N/A</td>
<td>aliphatic polycarboxylate and calcium chloride</td>
<td>28%</td>
<td>N/A</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td><strong>Water Conditioning Agents</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AQUASOFT</td>
<td>N/A</td>
<td>hydroxy carboxylic acid, phosphoric acids and ammonium sulfate polyacrylic acid</td>
<td>63%</td>
<td>N/A</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>CHOICE</td>
<td>N/A</td>
<td>polyacrylic, hydroxy carboxylic, propionic acids, phosphate ester and ammonium sulfate</td>
<td>50%</td>
<td>N/A</td>
<td>UAG</td>
</tr>
<tr>
<td>CRIMSON</td>
<td>N/A</td>
<td>ammonium sulphate: proprietary blend of agents</td>
<td>50:50%</td>
<td>N/A</td>
<td>Windfield Solutions</td>
</tr>
<tr>
<td>N TANK</td>
<td>N/A</td>
<td>monocarboxamide dihydrogen sulphate, amine phosphates and viscosity reducing agents</td>
<td>81%</td>
<td>N/A</td>
<td>Adjuvants Plus</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
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<th>Registration (PCP) Number</th>
<th>Chemical Composition</th>
<th>Concentration</th>
<th>Ontario Class</th>
<th>Manufacturer/Agent Code</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Defoamers (Anti-Foamers)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BREAKER</td>
<td>N/A</td>
<td>dimethylpolysiloxane</td>
<td>10%</td>
<td>N/A</td>
<td>Loveland Products</td>
</tr>
<tr>
<td>DIALED-IN</td>
<td>N/A</td>
<td>proprietary blend</td>
<td>100%</td>
<td>N/A</td>
<td>Windfield Solutions</td>
</tr>
<tr>
<td>FIGHTER F</td>
<td>N/A</td>
<td>dimethylpolysiloxane</td>
<td>12.5%</td>
<td>N/A</td>
<td>Loveland Products</td>
</tr>
<tr>
<td>FOMAINATOR</td>
<td>N/A</td>
<td>dimethylpolysiloxane, polypropylene glycol, silicon dioxide</td>
<td>15%</td>
<td>N/A</td>
<td>Windfield Solutions</td>
</tr>
<tr>
<td>FLAT-OUT</td>
<td>N/A</td>
<td>dimethylpolysiloxane</td>
<td>20%</td>
<td>N/A</td>
<td>Windfield Solutions</td>
</tr>
<tr>
<td>HALT</td>
<td>N/A</td>
<td>silicone base, neutral</td>
<td>30%</td>
<td>N/A</td>
<td>Corteva</td>
</tr>
<tr>
<td>VALID</td>
<td>N/A</td>
<td>lecithin, emulsifiers, glycols and dimethylpolysiloxane defoamer</td>
<td>100%</td>
<td>N/A</td>
<td>Loveland Products</td>
</tr>
<tr>
<td>ZAP</td>
<td>N/A</td>
<td>proprietary blend</td>
<td>100%</td>
<td>N/A</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td><strong>Deposition Aid &amp; Drift Control Agent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INTERLOCK</td>
<td>N/A</td>
<td>Modified vegetable oil and emulsifiers</td>
<td>100%</td>
<td>N/A</td>
<td>Windfield Solutions</td>
</tr>
<tr>
<td><strong>Foam Marker Dye</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IN-SIGHT</td>
<td>N/A</td>
<td>dye, surfactants, and coupling agents</td>
<td>100%</td>
<td>N/A</td>
<td>Norac Concepts Inc.</td>
</tr>
<tr>
<td>TREKKER TRAX</td>
<td>N/A</td>
<td>alcohols, mixed anionic and nonionic surfactants</td>
<td>54%</td>
<td>N/A</td>
<td>Loveland Products</td>
</tr>
<tr>
<td>TRAMLINE</td>
<td>N/A</td>
<td>nonionic and anionic surfactants</td>
<td>35% + 65%</td>
<td>N/A</td>
<td>Norac Concepts Inc.</td>
</tr>
</tbody>
</table>

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### TABLE 5–2. Adjuvant Rates per Sprayer Tank Volume

<table>
<thead>
<tr>
<th>% Adjuvant / Water</th>
<th>0.1% v/v</th>
<th>0.2% v/v</th>
<th>0.25% v/v</th>
<th>0.5% v/v</th>
<th>1.25% v/v</th>
</tr>
</thead>
<tbody>
<tr>
<td>L Adjuvant / L Water</td>
<td>1 L/1,000 L</td>
<td>2 L/1,000 L</td>
<td>2.5 L/1,000 L</td>
<td>5 L/1,000 L</td>
<td>12.5 L/1,000 L</td>
</tr>
<tr>
<td>L Adjuvant / U.S. gal. Water</td>
<td>0.38 L/100 U.S. gal.</td>
<td>0.76 L/100 U.S. gal.</td>
<td>0.95 L/100 U.S. gal.</td>
<td>1.9 L/100 U.S. gal.</td>
<td>4.75 L/100 U.S. gal.</td>
</tr>
</tbody>
</table>
AGRAL 90

Type of Adjuvant: Non-ionic surfactant.
Chemical Composition: Nonylphenoxy polyethoxyethanol 90%.
Registered Uses: For use with REGZONE, glyphosate, REFLEX and other control products as labelled. Also used for washing sprayer tanks and equipment.
Benefit: Improves chemical effectiveness.
Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixtures.
 Mixing: Use 200–2,500 mL/1,000 L of water as specified on label. Will mix with all types of water (i.e., hard and soft). Add AGRAL 90 to the spray mixture and agitate thoroughly. With glyphosate, use 350 mL/50–100 L water if targeting quackgrass in minimum or zero tillage seeding and summerfallow uses. Use 500 mL/100 L for quackgrass when water volumes are high (i.e., 150–300 L/ha).
Unique Characteristics: Do not exceed the labelled rates of AGRAL 90 as too much wetting agent can lead to loss of spray due to excessive run-off.

ALLIANCE 400

Type of Adjuvant: Compatibility agent.
Chemical Composition: Aliphatic phosphate ester, isopropanol and glycol ethers 69%.
Benefit: Emulsifies and disperses liquid fertilizers and emulsifiable pesticides in solution to produce uniform tank-mixes.
 Mixing: Mix 60–375 mL of Alliance/100 L of solution depending on fertilizer and number of pesticides. Add alliance to the fertilizer solution before the pesticide.

AMIGO

Type of Adjuvant: Surfactant.
Chemical Composition: 30% phosphate ester surfactant.
Registered Uses: For use with SELECT and SELECT tank-mixes.
Benefit: Improves chemical effectiveness under varying environmental conditions.
Mode of Action: Improves spreading of spray droplets on the leaf surface and increases contact area. Enhances penetration of herbicide through the leaf cuticle layer.
 Mixing: Half-fill spray tank with water and start agitation. Add the correct amount of herbicide, agitate and then add the correct amount of AMIGO with the remaining water. Continue to agitate.

AQUASOFT

Type of Adjuvant: Water conditioning agent.
Chemical Composition: Proprietary blend of hydroxy carboxylic acid, phosphoric acids and ammonium sulfate polyacrylic acid 63%.
Benefit: Eliminates hard water antagonism as well as formulation instability due to high pH.
Mode of Action: Conditions water by sequestering and chelating hard water ions and reducing the pH.
 Mixing: 100–750 mL/100 L of spray solution, depending on water hardness. Always check compatibility with a jar test.

AQUA-STABLE

Type of Adjuvant: Buffering agent.
Chemical Composition: Aliphatic polycarboxylate and calcium chloride 28%.
Benefit: Lowers the pH of the spray water and reduces pesticide breakdown from alkaline spray solutions.
Mode of Action: Acidifies and buffers spray solution.
 Mixing: 60–250 mL/100 L of spray solution, depending on the alkalinity.

ASSIST OIL CONCENTRATE

Type of Adjuvant: Mineral oil/surfactant (non-herbicidal).
Chemical Composition: 83% paraffin base mineral oil plus 17% surfactant blend.
Registered Uses: ASSIST OIL CONCENTRATE is registered for use with BASAGRAN, BLAZER, IMPACT, POAST and atrazine.
Benefit: Using ASSIST results in improved postemergence activity and a greater degree of consistency under varying environmental conditions. ASSIST also aids in providing a faster weed kill.
Mode of Action: Reduces the evaporation of spray droplets on the leaf surface leading to a longer period for penetration. Improves penetration through the leaf cuticle layer. ASSIST also aids in spreading a spray droplet on the leaf surface so that it covers a greater surface area.
 Mixing: Half-fill the spray tank with water and begin agitation. Add the desired amount of herbicide and continue filling. Add ASSIST last. After filling, continue agitation. Agitate thoroughly after any stoppage in spraying.
Unique Characteristics: May cause increased temporary topical burn to crop plants under hot, humid weather conditions.

BREAKER

Type of Adjuvant: Antifoamer/defoamer.
Registered Uses: To reduce foaming when preparing herbicide spray mixes.
Benefit: Small quantities of BREAKER added before adding herbicides will prevent foam from forming.
 Mixing: Add 7 mL/500 L of spray mix.
Unique Characteristics: Can be added after foam has formed but more time will be required to eliminate the foam.
**CITOWETT PLUS**

**Type of Adjuvant:** Non-ionic surfactant.

**Chemical Composition:** Ocyphenoxy-polyethoxy ethanol 70%.

**Registered Uses:** For use with atrazine, BASAGRAN, TELAR, MUSTER, REFINE, PINNACLE and other control products as labelled.

**Benefit:** Improves chemical effectiveness.

**Mode of Action:** It is a spreading and sticking agent that improves coverage of spray mixes.

**COMPANION**

**Type of Adjuvant:** Non-ionic surfactant.

**Chemical Composition:** Octylphenoxypolyethoxy-(9)-ethanol 70%.

**Registered Uses:** Glyphosate, TELAR, MUSTER and other products as labelled.

**Benefit:** Improves chemical effectiveness.

**Mode of Action:** It is a spreading and sticking agent that improves coverage of spray mixes.

**CONTACT**

**Type of Adjuvant:** Non-ionic surfactant.

**Chemical Composition:** Alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol at 900 g/L.

**Registered Uses:** For use with glyphosate*. TELAR, REFINE, MUSTER and other control products as labelled.

**Benefit:** Improves chemical effectiveness.

**Mode of Action:** It is a spreading and sticking agent that improves coverage of spray mixes.

**CRIMSON**

**Type of Adjuvant:** Water conditioning agent.

**Chemical Composition:** 50%: Ammonium Sulphate (AMS), and proprietary blend of water conditioning, coupling, and antifoam agents. 50%: Other Constituents.

**Benefit:** Many spray waters contain calcium, iron, potassium, sodium, and magnesium ions that tie up (antagonize) herbicide active ingredients such as glyphosate and glufosinate. Micronutrients also can antagonize glyphosate. AMS conditions the water to prevent hard-water and micronutrient antagonism.

**Mixing:** 1–1.5 L/100 L water.

**DIALED-IN**

**Type of Adjuvant:** Deposition aid and drift control agent.

**Chemical Composition:** 100%: proprietary blend.

**Benefit:** Dialed-In will reduce the amount of spray droplets that have a high potential to move off target in ground applications when applied through nozzles that are classified to produce extremely course and ultra course droplet spectrums.

**Mixing:** Use at a rate of 0.5% v/v.

**DRIFT-CONTROL AGENTS**

See DIALED-IN, VALID.

**ENHANCE NON-IONIC SPRAY ADJUVANT**

**Type of Adjuvant:** Non-ionic multipurpose adjuvant.

**Chemical Composition:** Triglyceride Ethoxylate 80%.

**Registered Uses:** ENHANCE can be used with glyphosate (numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, for a complete list of products), REGLONE, PURSUIT, ACCENT, ULTIM, REFINE and a wide range of other products as labelled.

**Benefit:** Improves chemical effectiveness.

**Mode of Action:** ENHANCE works by several modes of action which results in improving wetting, spreading and penetrative properties.

**Mixing:** Use 200–2,500 mL/1,000 L of water as specified on label. Will mix with all types of water (i.e., hard and soft). Add AGRAL 90 to the spray mixture and agitate thoroughly. For use with ROUDNUP and other glyphosate products use 350 mL/50–100 L for quackgrass, minimum or zero tillage seeding and summerfallow uses. Use 500 mL/100 L for quackgrass for water volume of 150–300 L/ha.

**Unique Characteristics:** ENHANCE contains no nonylphenoxy polyethoxy ethanol (NPE’s). Do not exceed labelled rates of ENHANCE as this may cause run-off.

**FIGHTER F**

**Type of Adjuvant:** Antifoamer/defoamer.

**Chemical Composition:** Dimethyl-polysiloxane 10%.

**Registered Uses:** To control foam in water, oil, fertilizer and pesticide spray mixtures.

**Benefit:** Controls foam when mixing sprays, eliminates material waste, provides more accurate metering of agricultural sprays, and eliminates foam overflow at fill sites.

**Mixing:** To control foam when mixing spray solution, add defoamer either just before or during addition of any other spray adjuvant. To cut existing foam, add defoamer to tank and recirculate solution until foam dissipates.
FLAT-OUT

**Type of Adjuvant:** Antifoamer/defoamer.

**Chemical Composition:** Dimethylpolysiloxane 20% Silicone base neutral.

**Registered Uses:** To control foam formation or existing foam, use as premix or add while spray tank is being filled.

**Benefit:** The reduction of foam allows for faster tank fill, ensures fill volumes are correct and reduces the possibility of chemical overflow, therefore more accurate application. It also makes the cleaning process easier.

**Mixing:** Add 5–10 mL/100 L of solution. Adjust the amount required according to individual conditions. May be used before mixing to prevent foam, or after to cut foam. May be used with any herbicide unless contra-indicated on the label.

HALT

**Type of Adjuvant:** Defoamer.

**Chemical Composition:** Silicone base, neutral.

**Registered Uses:** To reduce foaming when preparing herbicide spray mixes.

**Benefit:** The reduction of foaming allows faster tank fill-ups, ensures correct fill volumes, reduces the possibility of chemical overflow and gives more accurate herbicide application.

**Mixing:** Add 7 mL/500 L of spray mix. May be added to spray tank during filling to prevent foaming, or after to cut foam.

**Unique Characteristics:** May be used with any herbicide unless otherwise stated on the product label.

HASTEN NT

**Type of Adjuvant:** Non-ionic esterified vegetable oil.

**Chemical Composition:** Methyl and ethyl oleate 71.44%.

**Registered Uses:** For use with REFINE SG, ESCORT, TELAR and other herbicides as labelled.

**Benefit:** Improves herbicide uptake.

**Mixing:** Use 5 L/1,000 L of spray solution.

HIACTIVATE

**Type of Adjuvant:** Non-ionic liquid spreader/activator.

**Chemical Composition:** Alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol; 900g/L.

**Registered Uses:** For use with PURSUIT, ACCENT, ASSURE II, ULTIM, REGLONE and other products as labelled.

**Benefit:** Improves spray chemical effectiveness.

**Mode of Action:** It is a wetting and spreading agent that improves coverage of spray mixtures.

**Mixing:** Make sure the spray tank is thoroughly cleaned before mixing. Fill the spray tank half full with water. Add the required amount of herbicide as directed by its label with the agitator running. Ensure that the herbicide is completely mixed before proceeding to the next step. Slowly add the HIACTIVATE, agitating during the entire process. Continue to agitate while filling the tank with water and agitate before and during each application to ensure a uniform spray.

**Unique Characteristics:** Do not exceed labelled rates of HIACTIVATE, as too much may reduce the effectiveness of the herbicide due to excessive run-off. Consult product label for full directions.

ICON

**Type of Adjuvant:** Non-ionic surfactant.

**Chemical Composition:** Nonylphenoxo polyethyoxyethanol 90%.

**Registered Uses:** For use with REGLONE, glyphosate, REFLEX and other control products as labelled. Also used for washing sprayer tanks and equipment.

**Benefit:** Improves chemical effectiveness.

**Mode of Action:** It is a spreading and sticking agent that improves coverage of spray mixtures.

**Mixing:** Use 15–30 mL/100 L of spray solution.

INTERLOCK

**Type of Adjuvant:** Deposition aid and drift control agent.

**Chemical Composition:** 100%: modified vegetable oil and emulsifiers.

**Benefit:** InterLock is a spray adjuvant designed to improve deposition of the spray application onto the intended target. InterLock improves coverage and reduces drift and evaporation of pesticides being applied by ground or air.

**Mixing:** Use 200–300 mL/ha (80–120 mL/acre), do not add at a rate that exceeds 1% of the finished spray solution.
**IPCO AG-SURF**

**Type of Adjuvant:** Non-ionic surfactant.

**Chemical Composition:** Nonylphenoxy polyethoxyxethanol 92%.

**Registered Uses:** For use with REGLONE, glyphosate (numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, for a complete list of products) and other control products as labelled.

**Benefit:** Improves chemical effectiveness.

**Mode of Action:** It is a wetting and spreading agent that improves coverage of spray mixes.

**LI700**

**Type of Adjuvant:** Non-ionic surfactant and pH adjuster/acidifier.

**Chemical Composition:** Phosphatidylcholine, methylyacetic acid and alkyl polyoxyethylene ether 80%.

**Registered Uses:** REGLONE and for use with glyphosate products. LI700 neutralizes or slightly acidifies the spray solution and prevents the breakdown hydrolysis of pH-sensitive products in the spray tank. Add LI700 before adding the pesticide.

**Benefit:** Improves chemical effectiveness.

**Mixing:** As a penetrating surfactant: Use 5 L/1,000 L of water or 500 mL/100 L of water. As a pH adjuster/acidifier: Highly alkaline water, (pH 8 or higher). Use: 625 mL–1.25 L/1,000 L water mixture.

**MERGE, MERGE 1**

**Type of Adjuvant:** Surfactant/solvent.

**Chemical Composition:** 50% surfactant blend plus 50% solvent (petroleum hydrocarbons).

**Registered Uses:** For use with ERAGON LQ, IMPACT, POAST ULTRA and other products as labelled.

**Benefit:** Improves chemical effectiveness and provides a greater degree of consistency under varying environmental conditions.

**Mode of Action:** Improves spreading of spray droplets on the leaf surface and increases contact surface area. Improves penetration of herbicide through the leaf cuticle layer. Acts as a protectant against photodegradation of POAST ULTRA by UV light.

**Mixing:** Half-fill spray tank with water, start agitation. Add required amount of herbicide and continue agitation. Add MERGE, along with remaining water, last to the tank. Agitate thoroughly after any stoppage in spraying.

**Unique Characteristics:** May cause temporary topical burn to crop plants under hot, humid weather conditions.

**N TANK**

**Type of Adjuvant:** Water conditioning and compatibility agent.

**Chemical Composition:** A blend of monocarbamide dihydrogen sulphate, amine phosphates and viscosity reducing agents at 81%.

**Benefit:** Eliminates hard water antagonism. Prevents loss of herbicide activity that can occur when certain micronutrients are tank-mixed with glyphosate.

**Mode of Action:** Conditions water by sequestering and chelating hard water ions and added micronutrients.

**Mixing:** Add 0.25–1 L per 100 L spray solution prior to the addition of PRO-SURF II, as too much may reduce the effectiveness of the herbicide due to excessive run-off. Always check mixing compatibility first with a jar test.

**NUFARM AG-SURF**

**Type of Adjuvant:** Non-ionic surfactant.

**Chemical Composition:** Nonylphenoxy polyethoxyxethanol 92%.

**Registered Uses:** For use with REGLONE, glyphosate (numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, for a complete list of products) and other control products as labelled.

**Benefit:** Improves chemical effectiveness.

**Mode of Action:** It is a wetting and spreading agent that improves coverage of spray mixes.

**PRO-SURF II**

**Type of Adjuvant:** Non-ionic liquid spreader/activator.

**Chemical Composition:** Alkylarylpoloxoyethylene glycols, free fatty acids and isopropyl alcohol; 900g/L.

**Registered Uses:** For use with PURSUIT, ACCENT, ASSURE II, ULTIM, and other products as labelled.

**Benefit:** Improves spray chemical effectiveness.

**Mode of Action:** It is a wetting and spreading agent that improves coverage of spray mixtures.

**Mixing:** Make sure the spray tank is thoroughly cleaned before mixing. Fill the spray tank half full with water. Add the required amount of herbicide as directed by its label with the agitator running. Ensure that the herbicide is completely mixed before proceeding to the next step. Slowly add the PRO-SURF II, agitating during the entire process. Continue to agitate while filling the tank with water and agitate before and during each application to ensure a uniform spray.

**Unique Characteristics:** Do not exceed labelled rates of PRO-SURF II, as too much may reduce the effectiveness of the herbicide due to excessive run-off. Consult product label for full directions.

**SENTRY**

**Type of Adjuvant:** Non-ionic surfactant.

**Chemical Composition:** Nonylphenoxy polyethoxyxethanol 90%.

**Registered Uses:** For use with REGLONE, glyphosate and other control products as labelled.

**Benefit:** Improves chemical effectiveness.

**Mode of Action:** It is a wetting and spreading agent that improves coverage of spray mixes.
5. NOTES ON ADJUVANTS

SIDEKICK II

Type of Adjuvant: Non-ionic liquid spreader/activator.
Chemical Composition: Alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol; 900 g/L.
Registered Uses: For use with PURSUIT, ACCENT, ASSURE II, ULTIM and other products as labelled.
Benefit: Improves spray chemical effectiveness.
Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixtures.
Mixing: Make sure the spray tank is thoroughly cleaned before mixing. Fill the spray tank half full with water. Add the required amount of herbicide as directed by its label with the agitator running. Ensure that the herbicide is completely mixed before proceeding to the next step. Slowly add the SIDEKICK II, agitating during the entire process. Continue to agitate while filling the tank with water and agitate before and during each application to insure a uniform spray.
Unique Characteristics: Do not exceed labelled rates of SIDEKICK II, as too much may reduce the effectiveness of the herbicide due to excessive run-off. Consult product label for full directions.

SUFFIX

Type of Adjuvant: Non-ionic surfactant.
Chemical Composition: Nonylphenoxy polyethyoxyethanol 90%.
Registered Uses: For use with REGLONE, glyphosate (numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, for a complete list of products) and other control products as labelled.
Benefit: Improves chemical effectiveness.
Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixes.

SUPER SPREADER

Type of Adjuvant: Non-ionic spreader sticker surfactant.
Chemical Composition: Octyl phenoxypoly ethoxy ethanol 50%.
Registered Uses: For use with ACCENT, atrazine, BASAGRAN, MUSTER, PINNACLE, TELAR, PRISM, PYRAMIN FL, REFLEX, ULTIM and other products as labelled.
Benefit: Improves postemergence control of weeds that have reached their upper limit in size for susceptibility.
Mode of Action: Causes the spray mix to form a continuous film on leaf surfaces; also makes herbicide more rainfast.
Mixing: Use 1–2.5 L/ha. Half-fill tank with water; add herbicide with continuous agitation; complete filling of tank with water; add SUPER SPREADER with continuous agitation.
Unique Characteristics: Use the high rate (2.5 L/ha) with hard water.

SURE-MIX

Type of Adjuvant: Paraffinic petroleum oil/surfactant (non-herbicidal).
Chemical Composition: 60% Paraffinic petroleum oil plus 35.6% surfactant blend.
Registered Uses: SURE-MIX is registered for use with ASSURE II, and CLASSIC plus PINNACLE when tank-mixed with ASSURE II.
Benefit: The use of SURE-MIX results in improved activity of ASSURE II and a greater degree of consistency under varying environmental conditions.
Mode of Action: Reduces the evaporation of spray droplets from the leaf surface and decreases the surface tension of spray droplets thus improving penetration through the cuticle of leaf surfaces.
Mixing: Add the required amount of water to the spray tank with agitator running. Add ASSURE II and after well mixed add 5 L of SURE-MIX for each 1,000 L of spray solution.
Unique Characteristics: May cause some minor leaf speckling under hot and humid weather conditions.

TURBOCHARGE

Type of Adjuvant: Foam marker.
Chemical Composition: Nonionic and anionic surfactants, 35% + 65% alcohols and other constituents.
Benefit: Improves placement of herbicides by indicating area of field sprayed, preventing overlaps and misses.
Mixing: Depending on water hardness and mineral content mix 0.63–1 L/100 L of water.

TREKKER TRAX

Type of Adjuvant: Foam marker.
Chemical Composition: 24% alcohols and 30% mixed anionic and nonionic surfactants.
Benefit: Improves placement of herbicides by indicating area of field sprayed.
Mixing: Add 1–2 L of Trekker Trax to 100–150 L water. Use the higher rate of product if mixing with hard water.

TURBOCHARGE

Type of Adjuvant: Surfactant/solvent.
Chemical Composition: 39.5% surfactant blend plus 50% solvent (mineral oil).
Registered Uses: For use with ACHIEVE 40 DG herbicide.
Benefit: Improves chemical effectiveness and provides a greater degree of consistency under varying environmental conditions.
Mode of Action: Improves spreading of spray droplets on the leaf surface and increases contact surface area. Improves penetration of herbicide through the leaf cuticle layer.
Mixing: Half-fill spray tank with water, start agitation. Add required amount of herbicide and continue agitation. Add TURBOCHARGE along with remaining water last to the tank. Agitate thoroughly after any stoppage in spraying. Use at a rate of 0.5 L TURBOCHARGE/100 L of spray mixture. If tank-mixing with other herbicides, always add the TURBOCHARGE last.
UNITE

**Type of Adjuvant:** Compatibility agent.  
**Chemical Composition:** 83.7% acid polyglycols and methyl alcohol.  
**Benefit:** Improves the compatibility of liquid fertilizer-pesticide mixtures.  
**Mixing:** 240–1,420 mL/378.5 L. Perform a test of physical compatibility of various pesticides and fertilizer mixtures in a small quantity to determine the exact amount of UNITE and the mixing method to be used.

VALID

**Type of Adjuvant:** Deposition and drift reduction agent, antifoam-defoamer.  
**Chemical Composition:** Lecithin, emulsifiers, glycols and dimethylpolysiloxane defoamer.  
**Benefit:** Small quantities of VALID added before adding pesticides will prevent foam from forming. Adding VALID to the spray tank will also reduce the production of fine spray droplets that may drift.  
**Mixing:** Mix 125 mL/100 L of spray mixture.

WATER CONDITIONING AGENTS  
See AQUASOFT, CHOICE and N TANK.

WEEDAWAY AG-SURF

**Type of Adjuvant:** Non-ionic surfactant.  
**Chemical Composition:** Nonylphenoxy polyethoxyethanol 92%.  
**Registered Uses:** For use with REGLONE, glyphosate (numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, for a complete list of products) and other control products as labelled.  
**Benefit:** Improves chemical effectiveness.  
**Mode of Action:** It is a wetting and spreading agent that improves coverage of spray mixes.

X-ACT

**Type of Adjuvant:** Surfactant.  
**Chemical Composition:** 30% phosphate ester surfactant.  
**Registered Uses:** For use with ARROW and ARROW tank-mixes.  
**Benefit:** Improves chemical effectiveness under varying environmental conditions.  
**Mode of Action:** Improves spreading of spray droplets on the leaf surface and increases contact area. Enhances penetration of herbicide through the leaf cuticle layer.  
**Mixing:** Half-fill spray tank with water and start agitation. Add the correct amount of herbicide, agitate and then add the correct amount of MANA X-ACT with the remaining water. Continue to agitate.

XA OIL CONCENTRATE

**Type of Adjuvant:** Mineral oil/surfactant (non-herbicidal).  
**Chemical Composition:** 83% paraffin-base mineral oil plus 17% surfactant blend.  
**Registered Uses:** atrazine, YUMA GL, BASAGRAN and other products as labelled.  
**Benefit:** May result in improved postemergence activity.  
**Mode of Action:** Reduces the evaporation of spray droplets from the leaf surface and decreases the surface tension of spray droplets, thus improving the penetration through the cuticle of leaf surfaces.

XIAMATER OFX-0309

**Type of Adjuvant:** Non-ionic surfactant.  
**Chemical Composition:** Siloxylated polyether 76% + surfactant mixture 24%.  
**Registered Uses:** For use with PURSUIT on soybeans for annual broadleaf and grass control; and glyphosate for quackgrass control and annual broadleaf weed control in summer fallow; and with TORDON 101 for faster burndown of coniferous species on right-of-ways, Basagran on soybeans, Vision Silviculture and Vision Max Silviculture, Vantage Forestry, Ranman 400 SC, Fulfill 50 WG.  
**Benefits:** Improves chemical effectiveness by increasing the amount and rate of uptake of water-soluble herbicides.  
**Mixing:** Use 2.5 L/1,000 L of spray solution for most applications; add this amount last to the spray tank after the herbicide has been thoroughly mixed. Apply the spray solution as soon as possible after mixing.  
**Unique Characteristics:** This organosilicone formulation has lowest surface tension of any adjuvant available.

ZAP

**Type of Adjuvant:** Antifoamer/defoamer.  
**Chemical Composition:** Proprietary blend of ingredients.  
**Registered Uses:** To control foam formation or existing foam Use as premix or add while spray tank is being filled. For agricultural/industrial uses.  
**Benefit:** The reduction of foam allows for faster tank fill, ensures fill volumes are correct and reduces the possibility of chemical overflow. It also makes the cleaning process easier.  
**Mixing:** Add 2–5 mL/100 L of solution. Adjust the amount required according to individual conditions. May be used before mixing to prevent foam, or after to cut foam. May be used with any herbicide unless contra-indicated on the label. Is particularly effective with glyphosate products, which often foam in solution.