

4. 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. 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 amphoteric. 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. Amphoteric surfactants can be either anionic or cationic. Cationic and amphoteric 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 4–1. 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).

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

¹ Mention of a trade name in this table does not constitute a guarantee or warranty of the product. Neither does this use signify that these products are approved to the exclusion of comparable products. All trade names are capitalized in this guide.

² The product registration number for this trade name under the *Pesticide Control Product Act*, commonly referred to as a “PCP number”. The PCP number has been placed in the guide for convenience, but the pesticide label should always be used for the most accurate and current PCP number.

³ Designated under the *Pesticide Control Product Act* (PCPA) as pesticides of the Commercial Class for use in commercial activities that are specified on the label or Restricted Class when the label specifies essential conditions respecting the display, distribution or limitations on the use of, or qualifications of persons who may use the product. The Ontario Classification is current as of time of printing and may change over time. Refer to the Ontario Pesticide Advisory Committee Website, opac.gov.on.ca, for most current classifications.

TABLE 4–1. Adjuvants Used in Ontario (cont'd)**LEGEND:** N/A = not applicable. These types of products are not required to be classified under the *Pesticide Control Product Act* (PCPA).

Trade Names ¹	Registration (PCP) Number ²	Chemical Composition	Concentration	Ontario Class ³	Manufacturer/ Agent Code ⁴
Solvents (Oils)/Surfactants					
ADDIT ADJUVANT	29263	surfactant	36.9%	4	Adama Canada
AMIGO	22644	phosphate ester surfactant	30%	2	Arysta LifeScience
ASSIST OIL CONCENTRATE	16937	paraffin base mineral oil + surfactant blend	83% + 17%	4	BASF Canada Inc.
CARRIER	30639	mineral oil + surfactant blend	50% + 40%	4	NuFarm Canada
CONTENDER MSO	32198	methylated seed oil of soybean	70%	4	Interprovincial Coop
HASTEN NT ULTRA	31760	methyl and ethyl oleate	75.2%	4	Norac Concepts Inc.
MERGE	24702	surfactant blend + solvent (petroleum hydrocarbons)	50% + 50%	4	BASF Canada Inc.
MERGE1	21058	surfactant blend + solvent (petroleum hydrocarbons)	50% + 50%	4	BASF Canada Inc.
MSO CONCENTRATE	28385	methylated seed oil of soybean	70%	4	Loveland Products
SURE-MIX	25467	paraffinic petroleum oil + surfactant blend	60% + 35.6%	4	AMVAC Canada
TURBOCHARGE	23135	paraffin base mineral oil + surfactant blend	50% + 39.5%	4	Syngenta Canada Inc.
X-ACT	28225	phosphate ester surfactant	30%	2	Adama Canada
XA OIL CONCENTRATE	11769	paraffin base mineral oil + surfactant blend	83% + 17%	4	Loveland Products
XIAMETER OFX-0309	23078	silicone polyether + surfactant blend	76% + 24%	4	Norac Concepts Inc.
Combatibility Agents					
ALLIANCE	N/A	aliphatic phosphate ester, isopropanol and glycol ethers	69%	N/A	Norac Concepts Inc.
UNITE	N/A	acid polyglycols and methyl alcohol	83.70%	N/A	Loveland Products
Water Buffering Agents					
AQUA-STABLE	N/A	aliphatic polycarboxylate and calcium chloride	28%	N/A	Norac Concepts Inc.
Water Conditioning Agents					
AQUASOFT	N/A	hydroxy carboxylic acid, phosphoric acids and ammonium sulfate polyacrylic acid	63%	N/A	Norac Concepts Inc.
CHOICE	N/A	polyacrylic, hydroxy carboxylic, propionic acids, phosphate ester and ammonium sulfate	50%	N/A	UAG
CRIMSON	N/A	ammonium sulphate: proprietary blend of agents	50:50%	N/A	Windfield Solutions
N TANK	N/A	monocarbamide dihydrogen sulphate, amine phosphates and viscosity reducing agents	81%	N/A	Adjuvants Plus

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Trade Names ¹	Registration (PCP) Number ²	Chemical Composition	Concentration	Ontario Class ³	Manufacturer/ Agent Code ⁴
Defoamers (Anti-Foamers)					
BREAKER	N/A	dimethylpolysiloxane	10%	N/A	Loveland Products
DIALED-IN	N/A	proprietary blend	100%	N/A	Windfield Solutions
FIGHTER F	N/A	dimethylpolysiloxane	12.5%	N/A	Loveland Products
FOMAINATOR	N/A	dimethylpolysiloxane, polypropylene glycol, silicon dioxide	15%	N/A	Windfield Solutions
FLAT-OUT	N/A	dimethylpolysiloxane	20%	N/A	Norac Concepts Inc.
HALT	N/A	silicone base, neutral	30%	N/A	Corteva
VALID	N/A	lecithin, emulsifiers, glycols and dimethylpolysiloxane defoamer	100%	N/A	Loveland Products
ZAP	N/A	proprietary blend	100%	N/A	Norac Concepts Inc.
Deposition Aid & Drift Control Agent					
INTERLOCK	N/A	Modified vegetable oil and emulsifiers	100%	N/A	Windfield Solutions
Foam Marker Dye					
IN-SIGHT	N/A	dye, surfactants, and coupling agents	100%	N/A	Norac Concepts Inc.
TREKKER TRAX	N/A	alcohols, mixed anionic and nonionic surfactants	54%	N/A	Loveland Products
TRAMLIN	N/A	nonionic and anionic surfactants	35% + 65%	N/A	Norac Concepts Inc.

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TABLE 4–2. Adjuvant Rates per Sprayer Tank Volume

% Adjuvant / Water	0.1% v/v	0.2% v/v	0.25% v/v	0.5% v/v	1.25% v/v
L Adjuvant / L Water	1 L/1,000 L	2 L/1,000 L	2.5 L/1,000 L	5 L/1,000 L	12.5 L/1,000 L
L Adjuvant / U.S. gal. Water	0.38 L /100 U.S. gal.	0.76 L /100 U.S. gal.	0.95 L /100 U.S. gal.	1.9 L/100 U.S. gal.	4.75 L/100 U.S. gal.

AGRAL 90

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Nonylphenoxy polyethoxyethanol 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 wetting and spreading agent that improves coverage of spray mixes.

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.

CHOICE

Type of Adjuvant: Water conditioning agent.

Chemical Composition: Blend of polyacrylic, hydroxy carboxylic, propionic acids, phosphate ester and ammonium sulfate.

Benefit: Eliminates hard water antagonism and instability due to high pH.

Mode of Action: Conditions water by sequestering or chelating hard water ions and by the reduction in pH.

Mixing: 2.5–7.5 L/1,000 mL water.

CITOWETT PLUS

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Octylphenoxy-polyethoxy ethanol 50%.

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: Octylphenoxy-polyethoxy-(9)-ethanol 70%.

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

Benefit: Improves chemical effectiveness.

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

Mixing: With glyphosate, for the control of annual grasses and broadleaf weeds, add 450 mL of COMPANION in 50–100 L of water/ha. With TELAR, add 100 mL of COMPANION to 100 L of water for the control of broadleaf weeds. Use constant agitation.

Unique Characteristics: Do not exceed the labelled rates of COMPANION as too much may reduce the effectiveness of the herbicide due to excessive run-off.

CONTACT

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Alkylarylpoloxyethylene 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 coarse and ultra coarse 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 3–1. *Herbicides Used in Ontario*, for a complete list of products), REGLONE, PURSUIT, ACCENT, 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 site.

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: Alkylaryl polyoxyethylene glycols, free fatty acids and isopropyl alcohol; 900g/L.

Registered Uses: For use with PURSUIT, ACCENT, ASSURE II, 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: Nonylphenoxy polyethoxyethanol 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 wetting and spreading agent that improves coverage of spray mixes.

Mixing: Use 2,000–2,500 mL/1,000 L of water as specified on label. Will mix with all types of water. Add ICON 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 ICON as too much wetting agent can lead to loss of spray due to excessive run-off.

INDEX

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Alkylaryl polyoxyethylene glycols, free fatty acids and isopropyl alcohol at 900 g/L

Registered Uses: For use with ASSURE, PURSUIT, ACCENT 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.

IN-SIGHT

Type of Adjuvant: Foam marker dye.

Active Ingredients: Dye, surfactants, and coupling agents.

Uses: As a colour dye marker for foam markers and as a dye marking agent for turf applications.

Benefit: Allows foam marking systems to show up under poor visibility conditions of low light, heavy trash, no-till, snow or fog.

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 polyethoxyethanol 92%.

Registered Uses: For use with REGLONE, glyphosate (numerous products exist, refer to Table 3–1. *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, meth-ylacetic 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 micronutrients and certain pesticides, the exception being sulphonylurea herbicides (e.g., ACCENT, PINNACLE SG) which should be added first and fully dissolved prior to adding N TANK. Always check mixing compatibility first with a jar test.

NUFARM 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 3–1. *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: Alkylaryl polyoxyethylene glycols, free fatty acids and isopropyl alcohol; 900g/L.

Registered Uses: For use with PURSUIT, ACCENT, ASSURE II, 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 polyethoxyethanol 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.

SIDEKICK II

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

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

Registered Uses: For use with PURSUIT, ACCENT, ASSURE II 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 polyethoxyethanol 90%.

Registered Uses: For use with REGLONE, glyphosate (numerous products exist, refer to Table 3–1. *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 phenoxy poly ethoxy ethanol 50%.

Registered Uses: For use with ACCENT, atrazine, BASAGRAN, MUSTER, PINNACLE, TELAR, PRISM, PYRAMIN FL, REFLEX 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.

TRAMLIN

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 3–1. *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; Basagran on soybeans.

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.