Using adjuvants, surfactants and oils with herbicides

Herbicides often need help to spread across the leaf and penetrate the leaf surface of target weeds to give best results. Some herbicides have sufficient adjuvant and require no additional surfactants to perform well. However some do and this is usually detailed on the herbicide label. **Always read the herbicide label before opening the container and heed the information printed there.**

An **adjuvant** is any additive to a herbicide which is intended to improve the effectiveness of the herbicide. There are many products which have been developed to assist herbicides firstly contact the weed target, then remain on and penetrate the weed leaf surface. Adjuvants can be classified as follows:

Surfactants - are products which increases the spread of droplets, or the wetting of waxy or hairy leaf surfaces.
Surfactants consist of three different types:
anionic – have a negative charge and are not often used with herbicides.
cationic – have a positive charge – many domestic detergents. Rarely used with herbicides.
non-ionic surfactants –are the most commonly used in agriculture. They are non-reactive (no electrical charge). They remain on the leaf once dry and allow 'rewetting' after rain, permitting additional herbicide uptake e.g. BS 1000™, Agral™ 600.

Crop oils – most contain emulsifiers to allow them to mix with water and some contain various levels of surfactants. Some claims regarding oil adjuvants include reduced rainfast periods, more uniform droplet size (drift reduction) less spray evaporation and better penetration of herbicide into waxy leaves. Oils can be divided into two main groups:
Mineral oils **–** these products are usually a blend of mineral oil and non ionic surfactant. Products such as Ad-Here™ and DC Tron™ have low levels of surfactant, whilst Uptake™ and Supercharge™ have higher levels.

Vegetable oils **–** these products are a blend of vegetable oils and non-ionic surfactant and are sometimes called crop oil concentrates. Examples include Synertrol™ and Codacide™.

Esterfied vegetable oils – these are the more commonly used products and are produced by reacting vegetable oil with alcohol and then blending with a high level of non-ionic surfactant. The physical and chemical properties are quite different to that of vegetable oil. They have claims of superior wax-modifying characteristics and penetrating ability. They should be used strictly according to the label with selective herbicides. Hasten™ and Kwickin™ are examples of these products.

Penetrants – these are specific compounds which help dissolve waxy cuticles.

Acidifying/buffering agents - help lower the pH of the spray solution i.e. make solutions more acidic. Most herbicides are most stable when the pH of the solution is between 6 and 7 (neutral or slightly acidic). These include products such as LI700™ and Primabuff™ BB5.

Compatibility agents – material which reduces the likelihood of antagonism from other agents in the spray solution. The most commonly used compatibility agent is ammonium sulfate. It is also used to neutralise the effect of hard water on amine formulations such as glyphosate. Examples of these products are Liaise™, and Liquid Boost™. Some products combine a number of the above roles e.g. Hot-up™ contains a surfactant, a compatibility agent and an oil.

There are also a range of other adjuvants which are added to herbicides during formulation, that improve the efficacy, increase crop safety, or ease of herbicide use. These include thickeners, spreaders, stickers, anti-foamers and safeners.

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Factors affecting adjuvant use include:

1. **Crop safety –** addition of an adjuvant can reduce herbicide selectivity and thereby increase crop damage. This is not an issue for fallow and pre-emergent herbicides.

2. **Effectiveness or activity –** adjuvants are usually added to increase the effectiveness of herbicides, however use of the wrong type or rate can reduce effectiveness, such as decreasing herbicide retention on leaves.

3. **Water hardness –** hard water can lead to poor mixing of the chemical with water. This particularly occurs with emulsifiable concentrates. High levels of calcium and magnesium ions bind with amine formulations causing them to be less soluble and therefore less effective.

4. **Water temperature –** low water temperature can lead to gelling in the tank. High concentration herbicides might not mix and surfactants may perform poorly.

The following table identifies some commonly available adjuvants. Any omission is not intentional. Omitted products may perform as well as or better than the listed products.

Source: A. Storrie, C. Leckie, B. Milne, NSW Agriculture, (Published in 'Weed control in winter crops 2002', produced by NSW Agriculture).

Herbicide adjuvants

Trade name	Constituent	Company	Claim
Spray oil			
Uptake Spraying Oil	582 g/L paraffinic oil + 208 g/L non-ionic surfactants	Dow AgroSciences	Spreading/wetting agent for many selective herbicides
Hotwire spraying oil	598 g/L paraffinic oil + 210 g/L non-ionic surfactants	FarmOz	Spreading/wetting agent for many selective herbicides.
Ulvapron	855 g/L paraffinic petroleum oil	BP	Adjuvant/wetting agent
Caltex Broadcoat	861 g/L petroleum oil	Caltex	Adjuvant/wetting agent. Used with certain non-selective herbicides
Kwickin/Impel	704 g/L fatty acid esters of canola oil	Gullf Ag/Nufarm	Used with certain post-emergent herbicides.
Hasten	704 g/L fatty acid esters of canola oil + surfactant >15%	Victorian Chemical Co.	Wetting/spreading/penetrating agent for certain post emergent herbicides.
Activ oil/Fasta	704 g/L fatty acid esters of canola oil.	SST Products/Cobbett	Used with certain post-emergent herbicides.
Intac Ag Oil	820 g/L canola oil	Nipro Products	Improves droplet deposition, uptake
Supa Stik 100 Oil	840 g/L canola oil	Agrichem	Improves droplet deposition, uptake.
Protec	835 g/L canola oil + 70 g/L emulsifiers	Grevillia Ag	Improves droplet deposition, uptake. Used with non and selectives
Codacide	860 g/L vegetable oil Microcide	Microcide	Suitable for use with certain non- selective herbicides.
Synertrol	780 g/L emulsiflable vegetable oil	Organic Crop Protectants.	Wetter, spreader and penetrant compatible with most herbicides.
Bio-Shield/ Spray Tech	803 g/L emulsified vegetable oil	Spray Tech	Increase droplet deposition/coverage. Used with certain non-selectives.
Ad-Here	970 ml/L mineral oil	Victorian Chemical Co.	Adjuvant for Select, Verdict, Targa, Sertin 186 EC
Supercharge	432 g/L mineral oil	Crop Care	Designed for use with Achieve WG and Fusion WG.
DC Trate	763 g/L petroleum oil	Caltex	Anti-evaporant/wetting agent used with certain herbicides.
DC Tron	991 g/L petroleum oil	Caltex	See label.
Surfactants			
Agral 600	600 g/L non-ionic surfactant	CropCare	Wetting/spreading agent, for most selective and non selective herbicides.
Turbo Plus	850 g/L tallow amine ethoxylate	Monsanto	Used with Monsanto Roundup products.
Wetter TX	1040 g/L non-ionic surfactant	Monsanto	Used with Monsanto Roundups when treating certain grasses.
Pulse	1000 g/L polydimethylsiloxane	Monsanto	Wetting agent for use with glyphosate to control woody weeds
BS 1000/Maxiwet 1000	1000 g/L alkoxylated alcohol	Crop Care/Artfern	Wetting/spreading agent, for most non and selective herbicides.
Hot-up	340 g/L non-ionic + 190 g/L mineral oil + 140 g/L NH_4SO_4	Victorian Chemical Co	Wetting, penetrating, reduce antagonism of non-selective herbicides.
Activator	900 g/L non-ionic surfactant	Nufarm	Wetting agent. Used with most non and selective herbicides.
Wetter 1000	1003 g/L non-ionic ethoxylates	Chemag	Wetting/spreading agent, for most non and selective herbicides.
Wetspray 600	600 g/L non-ionic surfactant	Farmoz	Wetting/spreading agent, for most non and selective herbicides.
Wetspray 1000	1000 g/L non-ionic surfactant	Farmoz	Wetting/spreading agent, for most non and selective herbicides.
Surfactant 600	600 g/L non-ionic ethoxylates	Nufarm	Wetting/spreading agent, for most non and selective herbicides.
Chemwet 1000	1040 g/L non-ionic ethoxylates	Nufarm	Wetting/spreading agent, for most non and selective herbicides.
Agri-Wett 77	377 g/L nonylphenol ethylene	Agrichem	Wetting/spreading agent, for most non and selective herbicides.
AMS Rage/TTOP	183 g/L anionic-nonionic surfactant, 1% seaweed extract	TT Ag Res. Technologies	Penetration/wetting/uptake for certain non-selective herbicides.

Herbicide adjuvants

Trade name	Constituent	Company	Claim
Compatability agent			
Liaise/Liquid Assist/ etc	417 g/L ammonium sulfate	Nufarm/Rutec/Artfern	Minimise antagonism. For use with Glyphosate herbicides.
Alltask Benefit/Liquid Ammo	425 g/L ammonium sulfate	CRT/Davison	Minimise antagonism. For use with Glyphosate herbicides.
Liquid Boost/ Free	980 g/kg ammonium sulfate	Gullf Ag/Artfern	Minimise antagonism. For use with Glyphosate herbicides.
Bond Adjuvant	450 g/L synthetic latex + 100 g/L non-ionic surfactant	Nufarm	Used when the addition of a sticker, spreader and deposit agent is required.
Bonus	250 g/L ammonium sulfate + 188.5 g/L alkylethoxyphosphate	Nufarm	Designed for use with Nufarm Credit broadhectare only.
Talisman	666 g/L petroleum oil + 193 g/L polyoxyethylated surfactants	Spray Sure	Wetting/spreading/penetrating agent for certain post emergent herbicides.
Vicchem	291 g/L cationic-non-ionic + 215 g/L min. oil + 155 g/L NH_4SO_4	Victorian Chemical Co	Improves penetration, reduces antagonism, used with certain non-selectives.
Acidifying/ buffering agents			Wetter, spreader, acidifier, **not compatible** with sulfonylureas.
LI700	350 g/L soyal phospholipids + 350 g/ L propionic acid	Nufarm	Penetrant, buffering, acidifying, compatibility aid.
Primabuff BB5	255.7 g/L anionic-nonionic + 322.3 g/L non-ionic components	Davison	Wetter, spreader, acidifier, compatible with most herbicides.
Agri- Buffa	430 g/L phosphate esters, 100 g/L polyalkylene oxide	Agrichem	Stabilising pH, compatibility aid with tank mixes, of pH-sensitive herbicides.
Hydrobuff Adjuvant	85 g/L polyoxyethylene glyc + 370 g/L acetate buffer	Hygrotech Oceania	

Compiled by CJ Tonkin, NSW Agriculture. Published in 'Weed Control in Winter Crops 2002', NSW Agriculture. The omission of any products is not intentional.