



# **ADJUVANTS PRODUCT GUIDE**



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\* Spraymate Trade Marks

Adjuvants are a unique group of products that have the ability to greatly influence the performance of pesticides.

The use of adjuvants as management tools for agricultural chemicals can modify spray solutions by:

- > improving the physical characteristics,
- > reducing or minimizing chemical losses, and
- > maximising efficacy by enhancing penetration

The performance of herbicides, fungicides and insecticides can be affected by a number of variables. These include:

- > The environmental conditions at the time of application such as temperature, humidity and rainfall.
- > The properties of the water used for mixing such as pH and hardness.
- > The use of tank mixtures of different products which may effect efficacy and compatibility.
- > The condition of the target surface to be sprayed, for example, leaf surface texture, plant stress, insect growth stage, soil tilth and type.

Adjuvants maximise product efficacy when conditions are less than ideal, when low spray volumes are used, or when product performance needs to be modified or improved.

### **Adjuvant functionality and 'effect'**

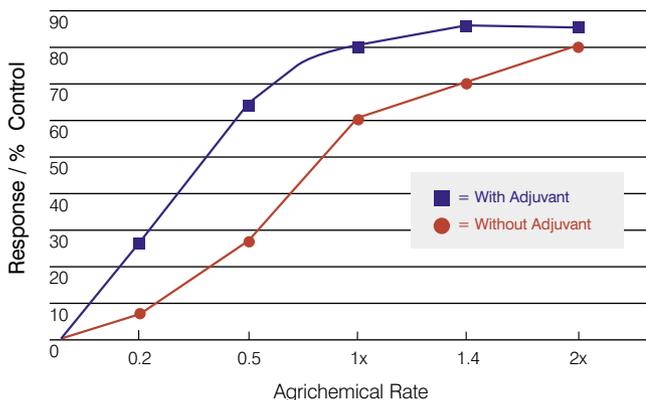
The functionality of an adjuvant is determined by its properties. The properties are determined by the design of the formulation. Functionality is specifically determined by the chemistry of the components, the proportions of the components and, the dose or quantity used.

# Introduction continued

Obtaining an 'effect' from the use of an adjuvant with an agricultural chemical will depend on what adjuvant property is added and in what amount, what pesticide is used and in what amount, the intended target, application efficacy and environmental conditions.

The graph below represents the dose responsive nature of the pesticide and pesticide/adjuvant combination. Note that the adjuvant 'effect' is inversely related to the pesticide dose. That is, a greater effect will be observed at lower rates. The 'effect' of the adjuvant can be represented by the difference between the two lines.

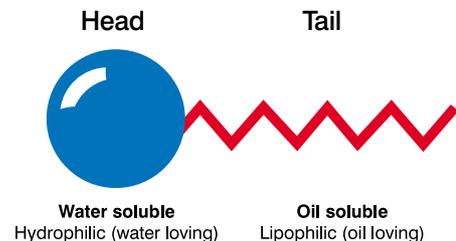
**Typical Response Curve of Agrichemical with and without adjuvant**



## Surfactant properties and behaviour

The single most common unique feature of a surfactant is not its chemistry, but its two-part structure. Every surfactant molecule will have a distinct portion that is to some degree, water soluble (hydrophilic), and a portion that is also to some degree, oil soluble (lipophilic). It is this dual set of diverse properties that will determine the surfactant's behaviour and functionality. General pictorial

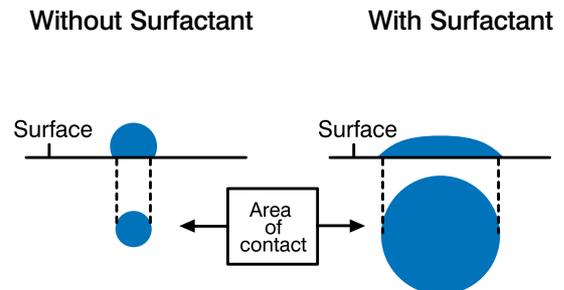
illustrations of surfactant molecules are usually represented as follows:



When surfactants are mixed with water, the 'head' portion attaches itself to water molecules. Due to the polar nature of both the 'head' and the water molecule, surface tension of the water is reduced (depending on concentration of the surfactant). Reduction will be non-linear until a maximum depression is achieved. Beyond this point, the addition of more surfactant does not result in further reduction of surface tension.

Surfactants will cause droplets to collapse under their own weight and dramatically increase the area of contact. This is one of the main reasons surfactants are used with pesticides to improve physical coverage over the surface of the intended target.

The following diagram illustrates the effect that surfactant has on reducing the surface tension of spray volume droplets



# Improve Coverage



Slender shiny leaf surfaces, hairy or waxy leaves and rainfall soon after spraying all contribute to poor coverage of spray droplets.

'Beading' of individual droplets on leaf surfaces means lack of contact area, which can translate to lower control levels from pesticides.

The solution is to reduce surface tension by using an adjuvant that:

- > makes spray droplets lie down or collapse to cover a wider area
- > assists entry of pesticides into target sites

# Improve coverage

SPRAYMATE™

## ACTIVATOR

Active constituent: 900 g/L Non-ionic surfactants

Spraymate Activator is a high quality wetting agent for use wherever a non-ionic surfactant is recommended on pesticide labels.

Spraymate Activator works by reducing the surface tension of the spray solution. This causes droplets to spread out evenly when they reach the target. Ingredients in Spraymate Activator also act on the leaf surface to increase chemical uptake.

Spraymate Activator contains an anti-foaming agent, so with less foam generated, together with Spraymate Activator's biodegradable active ingredients, it's safe to use and won't harm the environment.

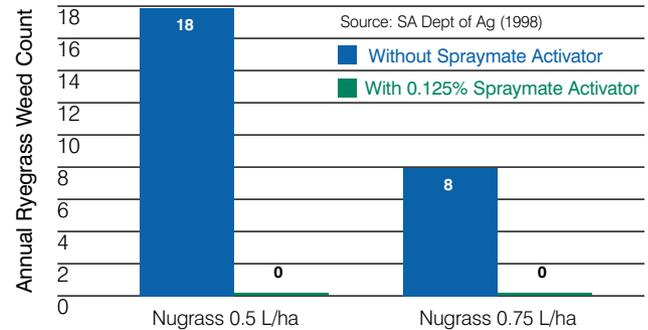
The practice of comparing application costs based on percentage dilution only assumes all wetters have the same active ingredient, but they don't. The high quality ingredients in Spraymate Activator means it can be used at lower rates than most other surfactants, therefore the application cost is likely to be lower than with similar products.

### Key benefits

- > Increases coverage and improves uptake
- > Improves performance of Nugrass for Annual ryegrass control
- > Reduces foaming of Nu-trazine Flowable herbicide
- > Improves performance of foliar fungicides - particularly systemics
- > Low foaming and biodegradable
- > Low application rates

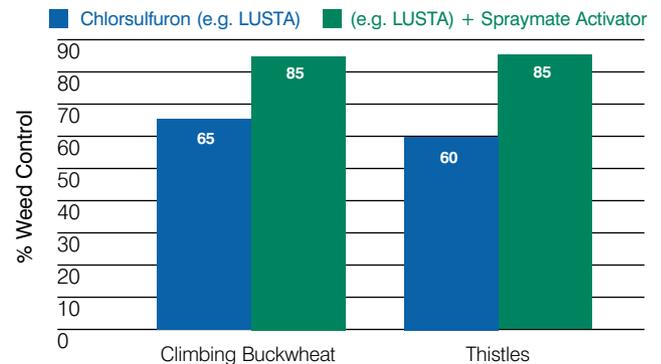


Effect of Spraymate Activator Surfactant on Annual Ryegrass control with Nugrass® (51 days after treatment)



Spraymate Activator increased herbicide effectiveness by 100%

Effect of Spraymate Activator Surfactant on Climbing Buckwheat & thistle control with Chlorsulfuron (60 days after treatment) Source: DuPont USA



Spraymate Activator increased herbicide effectiveness by up to 42%

# Improve coverage

## SPRAYMATE™ **CHEMWET 1000**

Active constituent: 1,000 g/L non-ionic ethoxylates

Spraymate Chemwet 1000 is a high quality, concentrated adjuvant formulation that contains a 100% non-ionic surfactant. Spraymate Chemwet 1000 is an excellent general purpose surfactant for use with most classes of agricultural chemicals.

Spraymate Chemwet 1000 reduces surface tension of the spray solution and improves wetting and spreading on waxy leaf surfaces. At high rates Spraymate Chemwet 1000 can also aid in the uptake of systemic herbicides such as glyphosate.

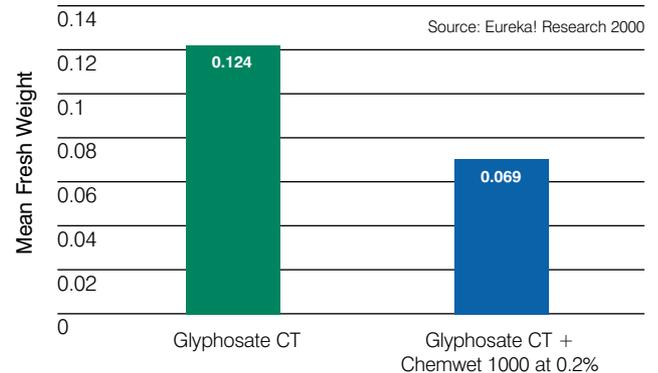
Spraymate Chemwet 1000 is highly concentrated. Not all non-ionic surfactants on the market are highly concentrated, with some containing as little as 200 g/L active ingredient. It is important to consider the quality of these formulations when choosing a surfactant product.

### Key benefits

- > Excellent general purpose surfactant
- > Highly concentrated formulation
- > Wide range of applications
- > Acts as a penetrant at high rates



### Effect of Spraymate Chemwet 1000 with Glyphosate CT on the Fresh Weight of Annual Ryegrass Foliage (14 days after treatment)



Spraymate Chemwet 1000 increased herbicide effectiveness by 45%



Resistant Annual ryegrass in a cereal crop

# Improve coverage

## PULSE® PENETRANT

Active constituent: 1,000 g/L Modified polydimethylsiloxane

Pulse is a non-ionic organosilicone super wetter and is widely recognized as a penetrant for use with glyphosate products to enhance penetration of woody weeds. However, the excellent spreading characteristics of Pulse make it extremely suitable for use with other agricultural chemicals\* including fungicides, insecticides, miticides and foliar micro-nutrients.

Pulse works by decreasing the surface tension of spray droplets so much, that the entire leaf surface can be wet by a small amount of spray solution. This greatly increases coverage, improves wetting of waxy leaves such as cabbages and gets to difficult-to-reach target sites in various crops.

The very low surface tensions produced with Pulse results in stomatal flooding which can not be achieved with normal non-ionic surfactants. This allows uptake of systemic pesticides through stomata and improves rainfastness.

### Key benefits

- > Excellent spreading characteristics
- > Ensures pesticide uptake
- > Enhances efficacy of Confidor® in cotton
- > Improves rainfastness

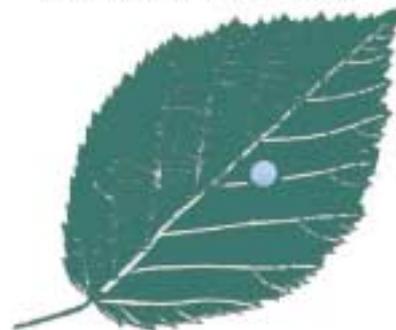
\* Registration pending at time of print



**QUALIFYING PRODUCT**



Water plus standard non-ionic wetter 0.2%



Water plus Pulse Penetrant 0.2%



Pulse improves the spread of water drops on leaves by up to 13 times.

*Adapted from "Effect of a new organo-silicone surfactant on droplet spread" J.Vitelli, Eighth Australian Weed Conference, 1987. (Droplets are shown larger than actual size.)*

# Improve coverage

## WETTER TX

Active constituent: 1,040 g/L Octyl phenol ethoxylate

Wetter TX is a special purpose non-ionic surfactant. It's recommended for addition to various Roundup® formulations to improve control of certain grass weeds - Annual ryegrass, Silver grass, certain perennial grasses and Serrated tussock.

A common use for Wetter TX is when Annual ryegrass is present. Annual ryegrass grows prolifically from autumn until early winter - when tillering occurs. In mid-winter, Annual ryegrass generally grows slowly due to short daylight hours and low temperatures. In spring warmer temperatures initiate a period of rapid growth. This is referred to as 'Phasic growth' and can vary from season to season.

As Annual ryegrass develops, the cuticle thickens and becomes more waxy. This combination of waxy cuticle and 'Phasic growth' has made stand-alone treatment with glyphosate often ineffective. Wetter TX has been proven to give reliable control of these harder-to-kill grasses in spring by enabling more efficient entry of Roundup® into the plant.

### Key benefits

- > Improves spray droplet coverage and penetration through waxy leaf surfaces
- > Ensures optimum Roundup® performance on Annual ryegrass and Silver grass in spring
- > Ensure optimum Roundup® performance on certain perennial grasses such as phalaris and couch



The following table indicates where Wetter TX is recommended with various Roundup® formulations. Always read the Roundup® label for full instructions and directions for use.

	*Annual ryegrass	*Silver grass	Perennial grasses	Serrated tussock
Roundup®	✓	✓	✓	
Roundup® CT	✓	✓	✓	
Roundup® Biactive™	✓	✓	✓	✓
Roundup® MAX	✓	✓	✓	✓
Roundup® Dry	✓	✓	✓	

\* Spring (from beginning of August to October).



**QUALIFYING PRODUCT**

# Minimise Losses



Natural phenomena such as temperature, moisture, sunlight, wind, and rainfall impact upon the degradation and adherence of spray droplets. Losses also occur through poor water quality (hardness and high pH), weed stress, or compatibility problems.

Extremes of natural phenomena, lack of adherence to repellent leaf surfaces, and the breakdown of pesticides, can translate to physical loss and reduced effectiveness.

The solution is to minimize losses by using an adjuvant that:

- > protects droplets from the elements, or
- > is capable of sticking droplets firmly to leaves, or
- > minimizes the effect of cationic metals in water, or
- > lowers the pH of spray water in the tank before mixing, or
- > reduces antagonism, or
- > manages droplet size

# Minimise Losses

## SPRAYMATE™ **BOND**

Active constituents: 450 g/L Synthetic latex, 100 g/L Surfactant

Spraymate Bond is a high quality sticker, deposition and retention agent for use with contact or protectant type fungicides or with contact and ingested insecticides.

The elastic properties of Spraymate Bond act to absorb the energy from spray droplets as they impact on the target. This improves spray droplet deposition through less shatter, bounce and runoff.

Spraymate Bond increases adherence of spray droplets by sticking them firmly to target surfaces. This protects pesticides against wash-off by rain or sprinkler irrigation, but Spraymate Bond does not encapsulate the droplet, so it enables maximum chemical activity over the leaf area. This is a considerable improvement over standard wetting agents.

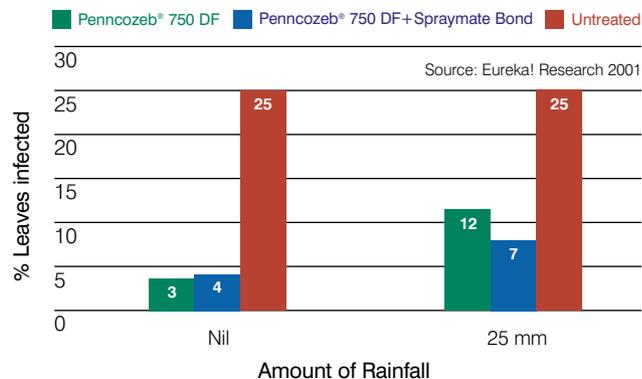
Spraymate Bond also protects chemicals by slowing the rate of degradation immediately after application, however it does not extend the life of products beyond recommended maximum residue limits, therefore it does not change established withholding periods.

### Key benefits

- > Improves spray droplet deposition
- > Retains and protects droplets on targets
- > Improves the performance and life of protectant fungicides and contact insecticides



## Effect of Spraymate Bond on Mancozeb Rainfastness



Spraymate Bond increased fungicide effectiveness by up to 41%

## Ascochyta control in Chickpeas



# Minimise Losses

## SPRAYMATE™ LI-700

Active constituent: 350 g/L Soyal phospholipids, 350 g/L Propionic acid

Under certain conditions, some agricultural chemicals are prone to alkaline hydrolysis - a phenomenon that results in the irreversible destruction of the active ingredient in alkaline spray solutions.

Spraymate LI-700 is a unique multi-purpose adjuvant. It decreases the pH of spray solutions, making them more acidic. This prevents losses when using pesticides that are susceptible to breakdown by 'alkaline hydrolysis'.

The effect of individual adjuvants on droplet size can be unpredictable. Often this can lead to the production of more driftable fine droplets as is seen with standard non-ionic surfactants.

Research conducted at Centre for Pesticide Application and Safety in Queensland has shown that Spraymate LI-700 will reduce the number of fine droplets produced when mixed with glyphosate, compared to glyphosate alone. This means that Spraymate LI-700 is the ideal adjuvant to use where spray drift is a concern.

### Key benefits

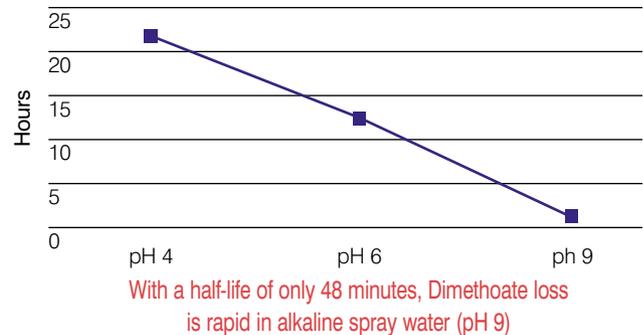
- > Manages losses caused by alkaline hydrolysis
- > Improves uptake of weak acid herbicides (e.g. glyphosate)
- > Produces fewer driftable droplets



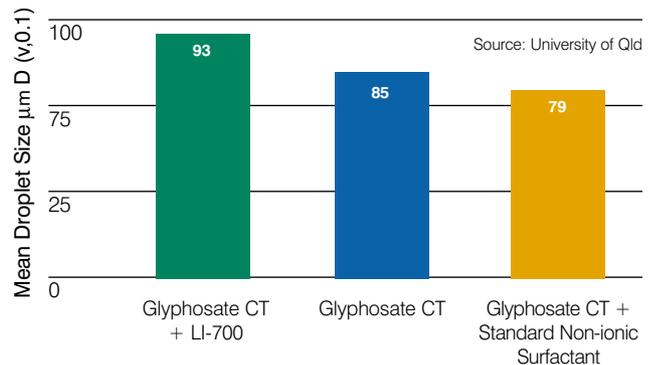
QUALIFYING PRODUCT



### Effect of pH on half-life in hours of Dimethoate



### Effect of Spraymate LI-700 on Mean Droplet Size when mixed with Glyphosate CT



Spraymate LI-700 increased average droplet size and minimised the potential for physical spray drift

# Minimise Losses

## SPRAYMATE™ LIASE

Active constituents: 417 g/L Ammonium sulfate

Spraymate Liase is a high quality aqueous solution of ammonium sulphate which is used to reduce antagonism with glyphosate under certain conditions.

Spraymate Liase should be added to glyphosate spray mixtures if the water being used contains magnesium, calcium or other cationic metals which make the water hard. If total water hardness is 250 ppm or more, then Spraymate Liase should be used.

When using Spraymate Liase, always add it to the water before anything else. If in doubt about water quality, take a sample and have it tested for total hardness and pH.

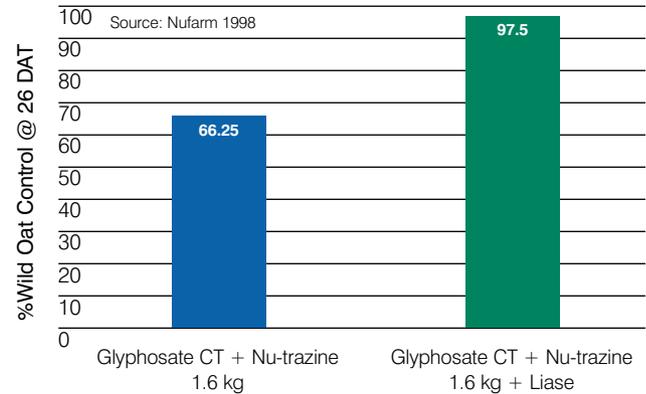
Spraymate Liase is also recommended in glyphosate tank mixtures with other herbicides especially SC and DF formulations such as atrazine, diuron and simazine, and when target weeds are under stress due to adverse conditions.

### Key benefits

- > Minimises the impact of hard water on glyphosate performance
- > Minimises antagonism between glyphosate and other herbicides
- > Improves glyphosate performance when weeds are stressed



### Effect of Spraymate Liase in minimising Glyphosate CT and Nu-trazine antagonism

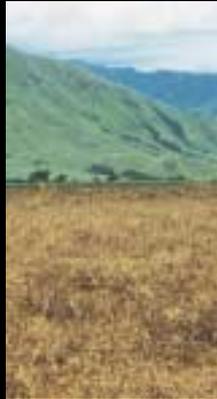


Spraymate Liase increased herbicide mixture effectiveness by 45%



Liase minimizes antagonism of Glyphosate CT + Nu-trazine to ensure effective weed control.

# Enhance Penetration



Herbicides must get past protective barriers in plants to be truly effective. Targets which have waxy, oily or hairy leaf surfaces, along with thick leaf cuticles or woody stems, can slow or resist penetration.

Difficult to penetrate barriers can translate to lower control levels and/or reduced uptake of foliar applied nutrients.

The solution is to enhance penetration by using an adjuvant that:

- > has good properties of solvency and water affinity, or
- > has superior spreading characteristics and actives capable of forcing entry into plants

# Enhance Penetration

## SPRAYMATE™ LI-700

Active constituent: 350 g/L Soyal phospholipids, 350 g/L Propionic acid

The unique attributes of Spraymate LI-700 are further illustrated by its ability to enhance penetration of herbicides and foliar fertilizers.

Spraymate LI-700 acts as an excellent penetrant for use with weak acid herbicides. It works in two key ways by reducing the pH of the spray solution it modifies the herbicide to become non-ionised. This form of the herbicide passes through plant cuticles more readily, resulting in faster uptake. The non-ionised form of the herbicide is also less susceptible to antagonism by cations found in hard water such as calcium and magnesium.

Spraymate LI-700 is composed of soyal phospholipids, these are natural surfactants found in plant cell membranes, at high rates these surfactants act on the waxy plant surfaces and decrease their resistance to aqueous herbicide solutions.

For foliar nutrients to be effective, they have to be absorbed through the leaf cuticle. Trials show that Spraymate LI-700 enhances the uptake by the plant of foliar nutrients, such as zinc, manganese, nitrogen, potassium, and phosphorus.

### Key benefits

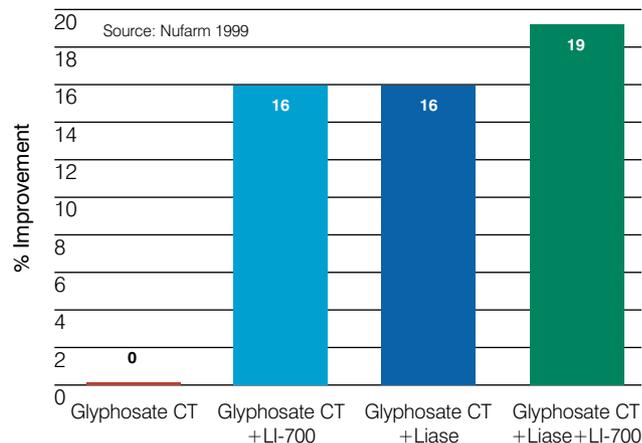
- > Enhances penetration of herbicides and foliar fertilisers



**QUALIFYING PRODUCT**

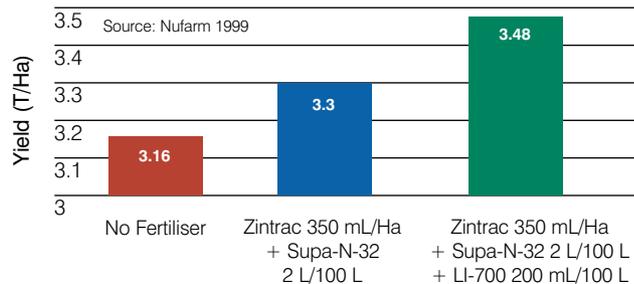


### Effect of Spraymate LI-700 on the Performance of Glyphosate CT (water pH 9, total hardness 1000 ppm)



Spraymate LI-700 increased herbicide effectiveness by 16%

### Effect of Spraymate LI-700 with Foliar Fertilisers on Wheat Yield Responses



Spraymate LI-700 with foliar fertilisers increased yield by up to 10%

# Enhance Penetration

## PRIMABUFF

Active constituent: 255.7 g/L Anionic components,  
322.3 g/L Non-ionic components

Primabuff BB5 has been specifically developed as a multi-functioning spray adjuvant, designed to cater for a wide variability in spray water quality.

Primabuff BB5 contains a pH colour indicator with a built-in logic that monitors the pH of the spray solution. A colour change reaction will confirm whether sufficient adjuvant has been added to the spray water, and when the optimal pH level has been reached. The colour of the spray water will automatically change to pink/red (dependant on water hardness) once the optimal pH range of 4.5 to 5.5 has been reached. This unique feature eliminates the necessity to repeatedly check either the water hardness or the pH with specialist equipment.

Primabuff BB5 is also useful for buffering spray solutions to pH 4 so that the uptake of gibberellic acid into citrus fruits is improved. This can help prevent rind creasing and softening disorder.

### Key benefits

- > Built-in colour indicator determines optimum pH level of spray solution
- > Enhances performance of Gibberellic acid in citrus and vines

Colour and pH reaction in water to increasing rates of Primabuff BB5

### Soft Water



### Hard Water



*Primabuff BB5 is the preferred adjuvant for use with Pro-Gibb® Gibberellic Acid (GA3)*



Packaging: 20 L

# Enhance Penetration

## PULSE® PENETRANT

Active constituent: 1,000 g/L Modified polydimethylsiloxane

Pulse is an incredibly effective organosilicone-based spray additive. This technology dramatically reduces surface tension to allow maximum spreading of spray droplets on plant surfaces. Pulse is so effective, it improves the spread of spray droplets on leaves by up to 13 times.

This superior coverage allows thorough penetration and translocation of certain herbicides used for hard-to-control brush and woody weeds. Pulse is suitable for use where pesticide labels recommend the addition of an organosilicone surfactant e.g. Trounce® Brush-Pack™ when treating Blackberry, Bracken, Gorse, Lantana, St John's wort and Sweet briar; glyphosate (Roundup®, Weedmaster® Duo), and metsulfuron methyl herbicides (Brushkiller® 600) when treating certain unwanted eucalyptus species, Bracken, Gorse and Lantana.

Trial work has also demonstrated that Pulse will improve Roundup® penetration significantly (10-fold), and increase translocation (almost four times) of a greater percentage of the applied Roundup®.

### Key benefits

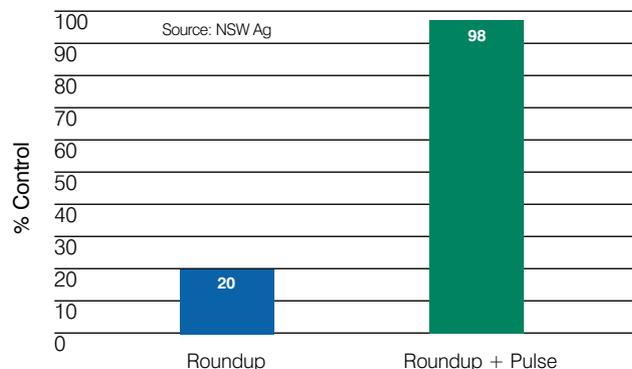
- > Superior spreading characteristics
- > Better penetration of plant tissue
- > Increases translocation within plants



QUALIFYING PRODUCT



Effect of Pulse Penetrant with Roundup® for control of Bitou Bush



Pulse increased effectiveness on hard-to-kill Bitou Bush by 390%

Effect of Pulse Penetrant with Brushkiller™ 600 for control of Bitou Bush



Pulse increased effectiveness on hard-to-kill Bitou Bush by 54%

# Feeding Attractant

## MOBAIT®

Active constituent: 265 g/L Food flavourings

Mobait is an insecticide spray additive that contains a unique blend of natural food extracts. Mobait imitates the high sugar and protein foods insect larvae are attracted to. Making insecticides attractive to insect pests will improve performance.

The primary function of Mobait is to improve the acceptance of insecticides by insects. This is particularly useful for many of the 'soft' IPM products used these days, which have to be ingested to work effectively.

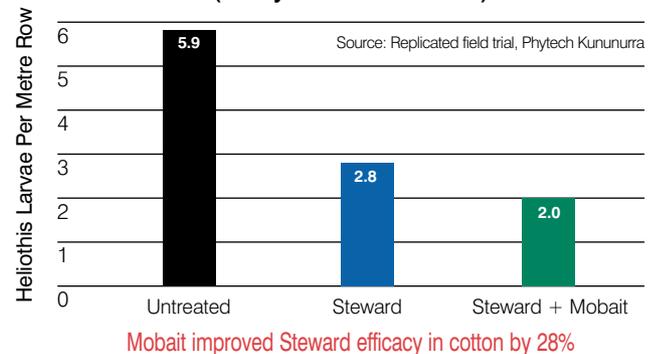
Mobait encourages feeding on sprayed leaves and results in a greater dose of insecticide being taken. It also encourages larvae (which are hidden in sheltered feeding sites such as flowers and bunches) to move onto sprayed surfaces to feed. This can help control entrenched larvae which are very difficult to control under normal conditions.

### Key benefits

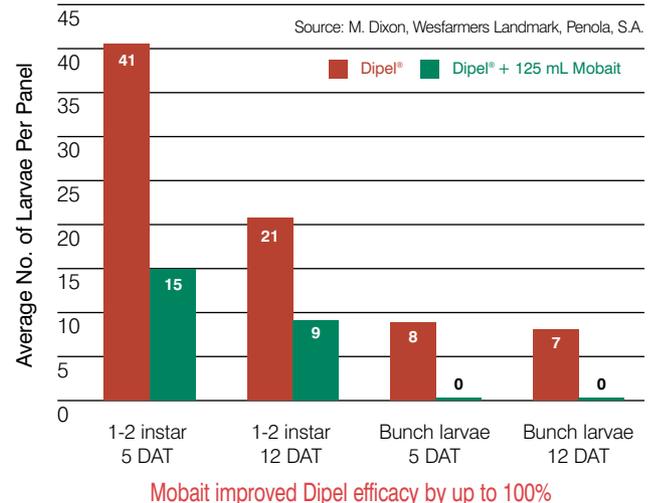
- > Attracts insects to sprayed surfaces
- > Encourages insects to ingest insecticide
- > Encourages larvae to move from sheltered areas and ingest insecticide
- > Improves efficacy of Bt's for Light Brown Apple Moth control in grapes



### Mobait + Steward® in Cotton (9 days after treatment)



### Control of Light Brown Apple Moth in Grapes



# General Products

SPRAYMATE™

## FOAM MARKER

Active constituent: 683 g/L Foaming agent

When using foam markers it is important to consider a number of factors that influence foam quality and survival. The single biggest influence on foam life is the temperature of the soil or vegetation onto which they are sprayed. In high temperatures foam life can be reduced especially on bare soil and in windy conditions. Foam quality and survival are also reduced when using hard water, or cold water to dilute the concentrate with.

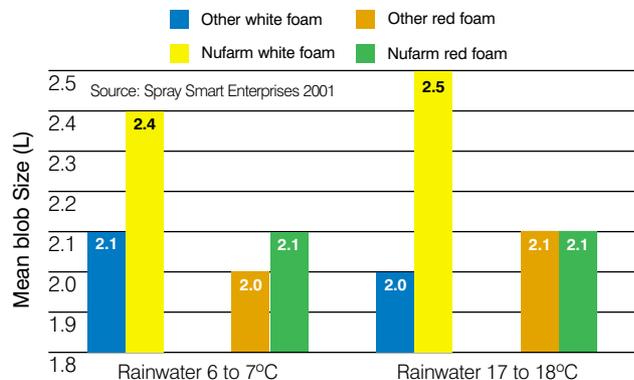
Nufarm has recently developed new improved formulations for red and white foam marker. An independent foam specialist evaluated these as the best in their class for foam quality, hard water stability, and cold water stability. All three formulations produced excellent foam at 2000 ppm hardness and at water temperatures of 6°C. Tests were also carried out on foam survival showing foam life greater than one hour on soil and grass with surface temperatures between 31°C and 44°C.

### Key benefits

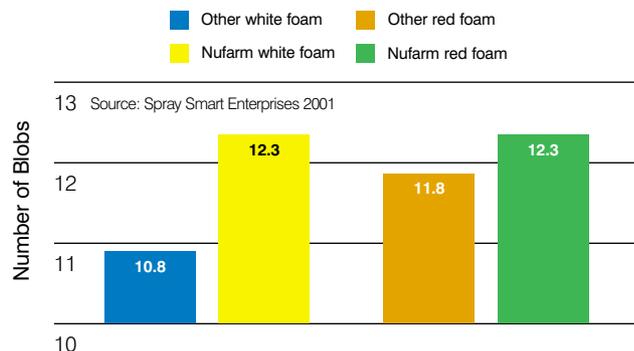
- > A unique high quality blend of foaming surfactants and foam stabilizers
- > Excellent cold and hard water stability
- > Long life even on hot soil
- > Available as white or red



### Effect of cold water on mean blob size



### Effect of hard water (500 ppm Ca Co<sup>3+</sup>) on the mean number of blobs produced



# General Products

## SPRAYMATE™ SPRAY MARKER DYE

Active constituent: 150 g/L Rhodamine B

Spraymate Spray Marker Dye is a red liquid dye to assist in the identification of areas sprayed with herbicides. Spraymate Spray Marker Dye is suitable for use with most formulations of agricultural chemicals, whether they be liquid, granular or powder products.

### Key benefits

- > Eliminates wastage by preventing double spraying
- > Can be used as a foam colouring agent in broadacre situations to indicate swath width
- > Saves time and money



Packaging: 5 L and 1 L

## SPRAYMATE™ T&E CLEANER

Active constituent: Sodium tripolyphosphate and industrial detergents

Small amounts of pesticide, which are safe to one crop, may be seriously damaging to another herbicide (e.g. Sulfoylureas such as Associate®, or grass selective herbicides such as Asset® - Haloxyfop). Frequent use of sprayers and changes of pesticide type means residues and contamination are a real threat to crop safety. Sprayers must be thoroughly cleaned when changing from one pesticide type to another.

Spraymate Tank & Equipment Cleaner is a mixture of powerful detergents, specifically designed to meet the demands of cleaning modern sprayers. The strong flushing action removes residues from non-accessible areas in the tank and spray lines. It also removes rust and hard water scale, and will leave a protective film to prevent corrosion during storage. Even if equipment is not subject to corrosion, the removal of minerals deposited by water can keep sprayers working longer.

### Key benefits

- > Powerful blend of industrial detergents
- > Removes rust, hard water scale, and assists in removing residues and stains
- > Prevents corrosion during storage



Packaging: 1 kg





**Nufarm**

[www.nufarm.com.au](http://www.nufarm.com.au)

**Nufarm Regional Offices**

**Northern Region**

QLD (07) 3893 8777

NSW (02) 6884 8180

**Southern Region**

VIC (03) 9282 1000

SA (08) 8444 6300

**Western Region**

WA (08) 9411 4000