### **Aid for Droplet Management**

Several independent studies have shown that LI 700 decreases the number of undesirable very fine droplets that are prone to drift as well as the number of undesirable very large droplets that are detrimental to good coverage and are prone to shattering when they reach their target. Generally speaking, LI 700 narrows the droplet spectrum at both ends of the spectrum and increases the number of droplets in the desirable range. In contrast, commonly used non-ionic surfactants often increase the number of droplets in the fine spectrum and therefore increase the risk for drift.





Figure 10 shows a droplet spectrum from a XR TeeJet 11002 Nozzle. This nozzle type is the most commonly used nozzle type in Australia. It produces fine droplets that can be very easily affected by drift. The addition of LI 700 lifts the droplet size at the fine end of the spectrum and increases the Volume Media Diameter (VMD), therefore decreasing the risk for drift.



Figure 11. Effect of LI 700 on coarse droplet spectrum of a Turbo TeeJet 11002 nozzle. Source: Centre for Pesticide Application, Gatton, QLD, 2004.

At the other end of the spectrum LI 700 has a positive effect as well. Figure 11 shows the droplet spectrum from a Turbo Teejet 11002 nozzle that creates large droplets to avoid drift. In this instance it is desirable to decrease the number of very large droplets. The addition of LI 700 lowers the Dv0.9 as well as the VMD and narrows the droplet sizes closer to the desired range. The nozzles will produce more droplets and will be more likely to provide increased coverage.

LI 700 is an excellent tool for droplet management and will assist nozzle performance but it should not be mistaken as a substitution for the right nozzle choice. LI 700 will reduce but not eliminate potential off target movement of spray droplets. Do not use in situations that are conducive to drift.

![](_page_0_Figure_9.jpeg)

Figure 12. Droplet velocity of a glyphosate spray with and without adjuvants. Source: Loveland Industries.

### Measurement of Droplet Spectrum

Droplet size is measured in microns ( $\mu$ m) = 1/1000 mm.

Spray nozzles produce a range of droplet sizes. The range will depend upon type and size of nozzles. Commonly used measurements to describe a droplet spectrum are VMD, Dv0.1 and Dv0.9.

• The Volume Median Diameter (VMD) is the point where half of the volume of the spray consists of droplets smaller than this size.

• Dv0.1 describes the finer end of the spectrum with 10% of the volume of spray consisting of droplets smaller than this size.

• Similar Dv0.9 describes the larger end of the spectrum with 90% of the volume consisting of droplets smaller than this size.

## LI 700 SURFACTANT **Give your crop**

# the adjuvantage.

- Prevention of chemical degradation
- Increased coverage
- Better uniformity of spray
- Better uptake

### **General Instructions**

LI 700 can be used where the addition of a wetter/spreader or self emulsifying oil is required or recommended on the agricultural label.

LI 700 is a penetrant, surfactant, acidifier for the use with herbicides, insecticides, fungicides, foliar fertilizers and plant growth regulators.

Mixing - Half fill the tank with water and commence agitation. Add the required quantity of LI 700 first, then add the recommended quantity of pesticide.

Do not use with copper products.

Always refer to the label.

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- Better translocation
- Increased rainfastness
- Increased efficacy
- Aid for droplet management

![](_page_0_Picture_40.jpeg)

### ice: Fax 1800 267 602 1800 707 543 1800 707 543 1800 133 206 1800 133 206

![](_page_0_Picture_42.jpeg)

# SURFACTANT

# **Give your crop** the adjuvantage.

![](_page_0_Picture_45.jpeg)

# LI 700° SURFACTANT - GIVE YOUR CROP THE ADJUVANTAGE

### **LI 700**

### Surfactant – Penetrant – Acidifier – Aid for Droplet Management

More than 200 adjuvants are registered in Australia. Many of them have little or no empirical data supporting their label claims. In contrast, LI 700 is one of the most researched adjuvants in the world and its multifunctional properties are well understood.

LI 700 is made from a blend of Lecithin oil, propionic acid (a weak organic acid) and various surfactants. This combination of ingredients gives LI 700 a wide range of properties that can greatly enhance pesticide performance in several ways.

### **Spreading and wetting**

LI 700 reduces the surface tension of spray droplets, allowing them to spread over a greater surface area which greatly increases coverage. In this regard LI 700 is not different to a typical adjuvant.

LI 700 does more. Its acidifying properties protect many pesticides from chemical degradation in the tank and provide a more favourable pH environment on the leaf surface for their uptake. Its multifunctional chemistry opens cuticle pathways in the waxy layer of the plant and increases penetration and translocation to the target sites.

### **Chemical Hydrolysis**

Alkaline hydrolysis is the chemical break down of pesticides in spray solutions that can occur if the water chemistry temporarily loosens the joints between used for spraving is alkaline. In Australia, most water used for spraying has varying degrees of alkalinity. Alkaline hydrolysis is affected by the susceptibility of the product, the pH of the water, duration of contact and temperature. A most alarming example of rapid breakdown is the insecticide dimethoate. It loses half of its activity in only 45 minutes when mixed with water pH 9. Table 1 shows some examples of pesticides affected by alkaline hydrolysis. Minimising breakdown can be achieved by acidifying the spray solution with LI 700 to the optimum pH level of 4 to 6. Unlike other acids that can over acidify the spray solution, the propionic acid in LI 700 is a weak acid that will not lower the pH beneath the safe level of pH 3.5. This becomes especially relevant for a droplet drying on the leaf surface. As the water is evaporating the concentration of acid will increase. Droplets containing LI 700 will remain buffered at a safe pH level around 3.5.

### Penetration

At rates of 250 mL/100 L and above the lecithin overlapping wax plates on the leaf surface. This enhances the uptake of herbicides, foliar fertilisers, fungicides and plant growth regulators. Unlike many other oils the disruption of the waxy layer by LI 700 has little side effects. The cuticular disruption by LI 700 is only temporary and the wax will reset to near normal (Picture 1). Therefore, in many horticultural situations LI 700 is soft on the crop when compared to other penetrating adjuvants.

![](_page_1_Picture_12.jpeg)

Normal structure undisturbed

adiuvani

to 11700

Structure after exposure

to petroleum oil-based

Structure after exposure

![](_page_1_Picture_14.jpeg)

![](_page_1_Picture_15.jpeg)

Picture 1. Annual ryegrass (Lolium rigidum) waxy cuticular.

	Examples of Pesticides subject to Alkaline Hydrolysis					
	Active	Brand Name	Comments			
	dimethoate	Dimethoate, Rogor <sup>®9</sup> , Sabotuer <sup>®</sup>	pH 9 = 45 min until 50 % breakdown			
1	carbaryl	Bugmaster <sup>®4</sup>	pH 9 = 3.2 hours until 50 % breakdown			
	phosmet	Imidan <sup>®8</sup>	pH 10 = 1 min until 50 % breakdown			
	dicofol	Kelthane <sup>®2</sup>	pH 10 = 15 min until 50 % breakdown			
	trichlorfon	Dipterex <sup>®4</sup> , Lepidex 500	pH 8 = 63 min until 50 % breakdown			
	alpha-cypermethrin	Fastac®Duo, Dominex®	hydrolysis under strong alkaline conditions			
	iprodione	Rovral®	pH 9 = less than 1 hour until 50 % breakdown			

The majority of pesticides prefer a slightly acidic milieu in the range of pH 6 or less. Some plants, especially broadleaf weeds have surfaces that are naturally high in pH (alkaline) that hinders the uptake of weak acidic pesticides. The acidifying properties of LI 700 help to create a more favourable pH environment for the pesticide on the leaf surface. With its penetrating properties LI 700 enhances speed and overall uptake of products and increases efficacy and rainfastness.

### **Enhancement of Rainfastness**

![](_page_1_Figure_20.jpeg)

Figure 1. Wild radish, effect of LI 700 on rainfastness of Glyphosate 450CT at 1.2 L/ha. Source: A. Wells, Plant Protection Quarterly Vol 4(4) 1989.

Faster penetration into the plant means less exposure to detrimental weather conditions. This effect of LI 700 is demonstrated in Figure 1. LI 700 aids in the quick uptake of glyphosate into the waxy layer of radish and increases the rainfastness dramatically. In the same study similar results were observed on wild oats, annual ryegrass and hedge mustard.

### **Increase in Uptake of Foliar Fertilisers**

LI 700 enhances the uptake of foliar fertilisers in a wide range of horticultural crops. Trials have shown improved uptake of iron, zinc, manganese and boron when formulated as salt, chelate or sulphate.

![](_page_1_Figure_25.jpeg)

Figure 2. Citrus - increased foliar trace element uptake with LI 700 at 1.4 L/ha, Zn-Mg 18x15 at 5.6 kg/ha, MKP(0-52-34) at 11.2 kg/ha. Source: Gless, 2000

For example, in a trial conducted in citrus LI 700 enhanced the uptake of manganese, zinc and iron (Figure 2). There was no effect on copper uptake. Copper products generally prefer a higher pH and should not be mixed with LI 700.

In a different trial in citrus LI 700 increased the uptake of foliar urea when compared to the use of a non-ionic surfactant (Figure 3). The indirect urea uptake measurement of chlorophyll reading shows an increase in photosynthetic activity shortly after application.

![](_page_1_Figure_29.jpeg)

Figure 3. Citrus - increased uptake of foliar applied urea. Source: Yuma, 1998.

Especially the uptake of manganese benefits from the use of LI 700 as a further trial in onions shows (Figure 4). LI 700 increased the uptake of the chelated formulation as well as the sulphate form.

![](_page_1_Figure_32.jpeg)

Figure 4. Onions - increased uptake of manganese into plant when applied as a chelate or sulphate foliar application. LI 700 at 0.5% v/v. Source: Asselin, 1999.

In apples LI 700 increases the calcium concentration in fruit and leaves when used with calcium chloride (Figure 5). No phytotoxic effect was observed. When compared to standard non-ionic surfactants the increased uptake of calcium resulted in a significant 24% reduction of bitter pit.

![](_page_1_Figure_35.jpeg)

Figure 5. Apples - changes of calcium levels of Cox Orange after calcium chloride treatment. LI 700 at 0.3% v/v. Source: Geelen, 1997.

The uptake of boron was increased in Broccoli when Borosol was used with LI 700 (Figure 6).

![](_page_1_Figure_38.jpeg)

Figure. 6. Broccoli - increased uptake of boron. LI 700 at 0.5% v/v . Source: Fafard, 1999

### **Translocation**

LI 700 does not only affect the uptake of chemicals into the plant but also their translocation inside the plant. For example, Cycocel<sup>®2</sup> 77A (chlormequat) a Plant Growth Regulator (PGR) for grapevines has limited mobility in the plant. Figure 7 shows the results of an experiment in which chlormequat was only applied to the middle of a cereal leaf.

![](_page_1_Figure_42.jpeg)

Without adjuvant Cycocel showed limited uptake and movement. The treatment containing LI 700 demonstrated the best uptake, resulted in the best translocation and was the only treatment where Cycocel moved down to the base of the leaf.

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Another PGR extensively used in table grapes is Gibberellic Acid (GA). Trials indicate that at low LI 700 rates of 0.08 - 0.125% the use of LI 700 increased the uptake of GA, resulted in better sized berries and less compact bunches (Figure 8 and 9). No crop effect was observed.

![](_page_1_Figure_45.jpeg)

Figure 8. Table grapes - increased berry size in Thompson dless, Source: Loveland Industries

![](_page_1_Figure_47.jpeg)

Figure 9. Table grapes - increased stem and branch length in Thompson Seedless bunches. Source: Loveland Industries.

![](_page_1_Picture_49.jpeg)

Figure 7. Effect of LI 700 on uptake and translocation of equat in a wheat leaf. Source: University of Essex.