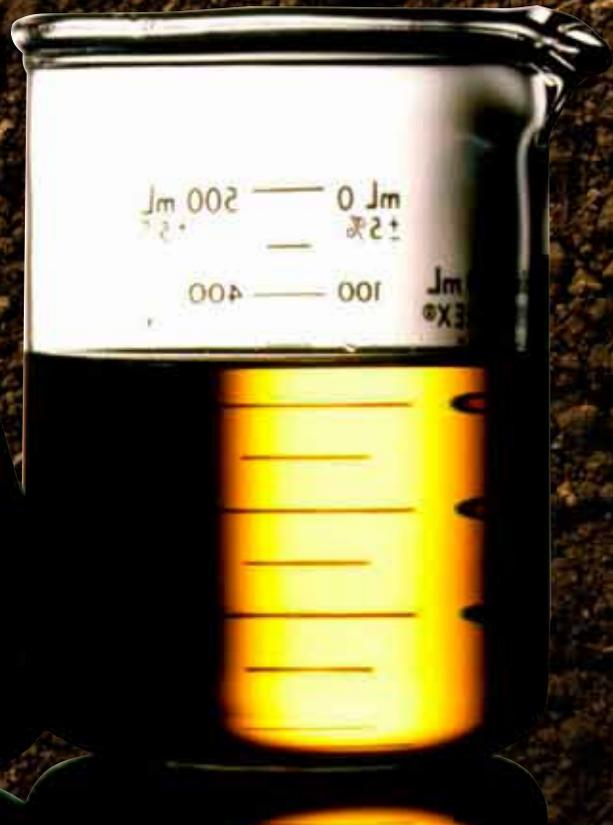
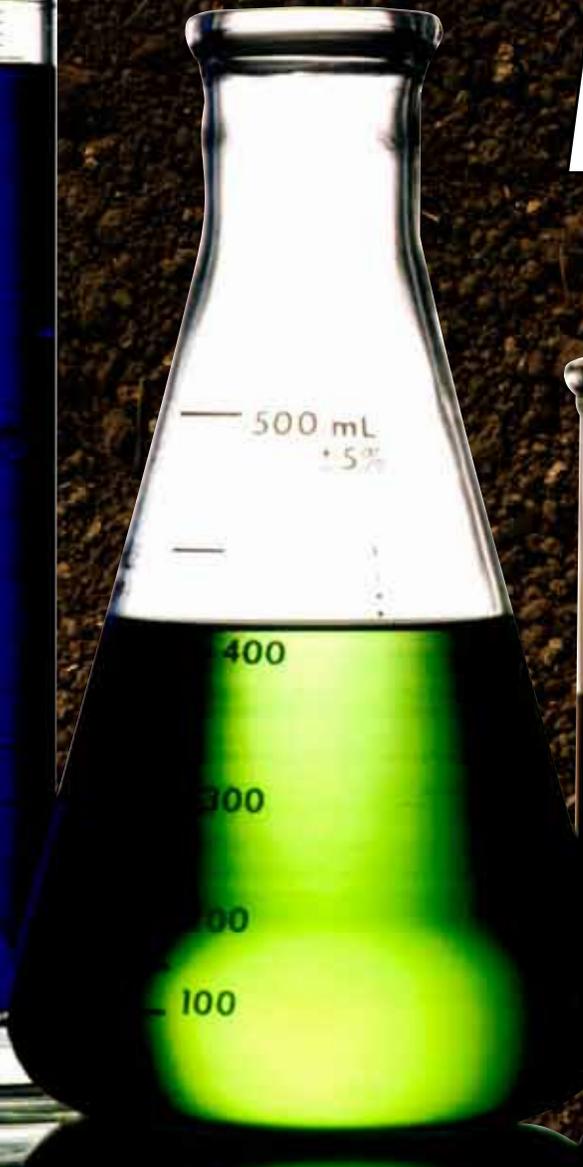




WILLOWOOD USA 

Quick Guide to Spray Adjuvants

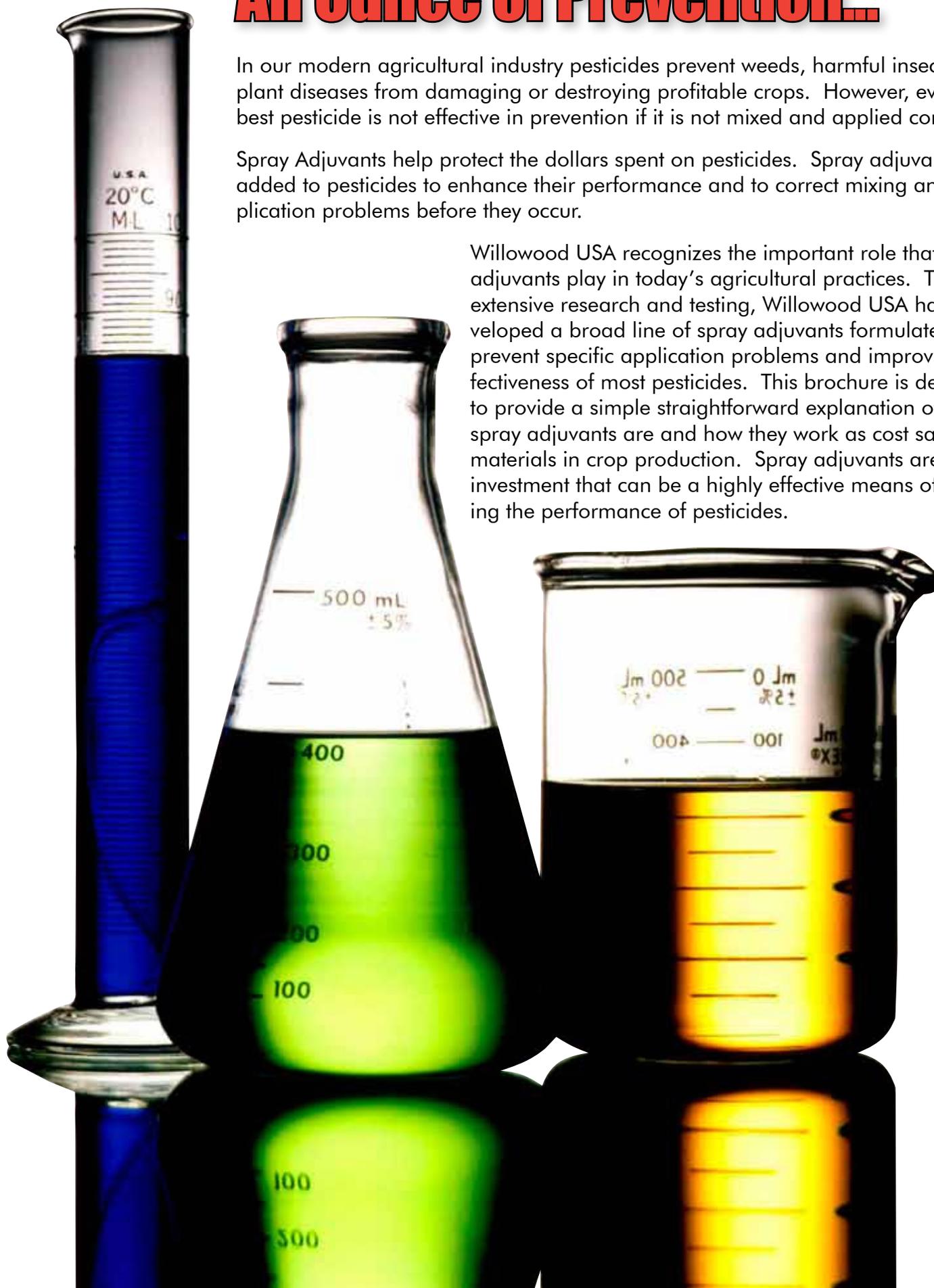


An Ounce of Prevention...

In our modern agricultural industry pesticides prevent weeds, harmful insects and plant diseases from damaging or destroying profitable crops. However, even the best pesticide is not effective in prevention if it is not mixed and applied correctly.

Spray Adjuvants help protect the dollars spent on pesticides. Spray adjuvants are added to pesticides to enhance their performance and to correct mixing and application problems before they occur.

Willowood USA recognizes the important role that spray adjuvants play in today's agricultural practices. Through extensive research and testing, Willowood USA has developed a broad line of spray adjuvants formulated to prevent specific application problems and improve the effectiveness of most pesticides. This brochure is designed to provide a simple straightforward explanation of what spray adjuvants are and how they work as cost saving materials in crop production. Spray adjuvants are a small investment that can be a highly effective means of protecting the performance of pesticides.



The Fundamentals

Simply Stated: A Spray Adjuvant is either...

#1 - An Additive that Corrects Mixing or Application Problems.

These spray adjuvants are designed to prevent and control very specific problems that may occur by combining and applying pesticides and fertilizers. Some of these spray adjuvants prevent foam, reduce drift, correct pH levels and/or prevent solutions from separating when mixed.

#2 - An Additive that Improves the Performance of a Pesticide.

Spray adjuvants that work to improve the performance of pesticides do so by enhancing the reaction of the pesticide solution when it comes into contact with the leaf surface. Spray adjuvants, sometimes call surfactants (surf-surface, act-active, ants-agents) help reduce surface tension to allow a pesticide to cover, penetrate and/or adhere to the leaf's surface depending on whether they have an anionic, nonionic or cationic charge.

Anionic, Nonionic and Cationic Charges are Chemical Bonds, which affect the Relationship between Spray Solutions and Leaf Surfaces.

Like-poles of magnets will repel each other and unlike-poles attract. Spray adjuvants have properties similar to magnets. Most leaf surfaces are negatively charged and spray adjuvants may be negatively, neutrally or positively charged.

Negatively charged solutions are referred to as ANIONIC	Neutrally charged solutions are referred to as NONIONIC	Positively charged solutions are referred to as CATIONIC
<i>When a negatively charged solution comes in contact with a negatively charged leaf surface the solution will be repelled or caused to spread over the leaf.</i>	<i>When a neutrally charged solution comes in contact with a negatively charged leaf surface the solution will penetrate and spread on the leaf.</i>	<i>When a positively charged solution comes in contact with a negatively charged leaf surface the solution will be attracted or caused to stick on the leaf.</i>
Many spray adjuvants are formulated to perform more than one of these functions.		

*Amphoterics are naturally occurring substances that exhibit the combined properties of anionic, nonionic and cationic.

Most EPA pesticide labels will make specific recommendations to use a spray adjuvant that contains either an anionic, nonionic or cationic surfactant. It is important to remember that the total percent of "active ingredient" in a spray adjuvant is a combination of more than one ingredient, including but not exclusively surfactant.

The Functions

With over 500 pesticides currently on the market, the use of spray adjuvants is continually increasing. Most EPA registered pesticides have very specific recommendations for use of one or more spray adjuvants. Each spray adjuvant manufactured is designed to perform a very specific function under unique circumstances.

Spray adjuvants may perform and of the following functions:

- Spreading
- Preventing Foam
- Dispersing
- Preventing UV Breakdown
- Enhancing Biological Activity
- Sticking
- Buffering
- Controlling Drift
- Emulsifying
- Mixing
- Penetrating
- Wetting
- Marking
- Attracting
- Extending

Willowood USA spray adjuvants are divided into seven different categories. Within each category, several different spray adjuvants exist. The differences between certain spray adjuvants may seem subtle on the label, but may have dramatic effects on the spray mix. For this reason it is important to always read the pesticide label and spray adjuvant label carefully before mixing or applying any solution.

Spray Adjuvants that correct mixing and application problems	Spray Adjuvants that improve the performance of pesticides
<p>Buffers - Spray adjuvants that adjust the pH of alkaline waters.</p> <p>Compatibility Agents - Spray adjuvants that allow pesticides to mix with water, or spray adjuvants that allow pesticides to mix with fertilizers.</p> <p>Drift Control Agents - Spray adjuvants that reduce the amount of spray solution drift.</p> <p>Anti-Foam Agents - Spray adjuvants that prevent the formation of foam in a spray solution.</p>	<p>Penetrants - Spray adjuvants that enhance a pesticide's ability to penetrate a leaf surface.</p> <p>Spreaders - Spray Adjuvants that reduce surface tension of pesticide droplets to such an extent that they can spread and merge together even over waxy surfaces.</p> <p>Stickers - Spray adjuvants that help pesticide droplets adhere firmly to their targets and resist wash-off by rain or irrigation water.</p>

*All Willowood USA Spray Adjuvants are exempted from tolerance levels as defined by the Environmental Protection Agency and meet the stringent regulation of the State of California.

Also Know As...

Penetrants - Activators | Solvents | Methylated Oils

Spreaders - Crop Oils | Crop Oil Concentrates | Wetters | Wetting Agents | Vegetable Oils

Buffers - Acidifiers | Water Conditioning Agents | pH Adjusters | Buffering Agents

Compatibility Agents - Suspension Agents | Blending Agents | Dispersants | Binders

Drift Control Agents - Thickeners | Deposition Agents | Drift Retardants

Anti-Foam Agents - Defoamers | Foam Suppressants



Buffers

Most pesticides are designed to be applied using water as the carrier. Unfortunately some water sources have very high pH. Many pesticides work most effectively on the slightly acidic side, somewhere in the pH 4.5 to 6 range. Many water sources test pH 7.5 and higher – far over on the alkaline side of the scale.

High pH (alkaline) water can and does cause some pesticide material to undergo a chemical breakdown or degradation called “alkaline hydrolysis.” Alkaline water increases the decomposition rate of many pesticides, often resulting in a much poorer pesticide performance than expected. The pesticide losses due to alkaline hydrolysis are permanent, irreversible and costly.

Buffers are spray adjuvants that lower the pH of water and hold it at the lower pH as pesticides and nutrients are added.

Avoid pesticide breakdown by buffering spray water before mixing. Buffers adjust alkaline waters to a pH that is slightly acidic, which is ideal for many pesticides.

Compatibility Agents

Mixing an herbicide, an insecticide, a fungicide and a nutrient together in one tank is an accepted spraying method. The combination of products saves time. One application across the field can increase the number of pests controlled. However, these products are not necessarily compatible and may not mix uniformly. So, the time-saving method could become a costly waste of several products that are unable to perform because they are incompatible with each other.

Compatibility agents are spray adjuvants that correct mixing problems. Certain compatibility agents allow pesticides to mix with water and others allow pesticides to mix with fertilizers. Willowood USA always recommends that a simple jar test for compatibility be conducted before actually mixing an entire spray tank.

A compatibility agent allows solutions to mix uniformly, which assures even field applications.



Drift Control Agents



The addition of a drift control agent enlarges water droplets (above), reducing the fine mist (right).

Most pesticides are applied to crops by means of some type of spray rig or aircraft. The nozzle size, angle and pressure with which the pesticides are applied can be controlled. However, many of the pesticides spray droplets may not reach their intended target. In fact, most small droplets drift away from the target, especially in windy conditions. This can be a very costly pesticide application problem, because droplets that are not on the intended target are either on a neighbor's crop or are wasted in the air.

Drift control agents are spray adjuvants that reduce spray mist by increasing the size of the droplets. Drift control agents unite tiny particles that make up the spray pattern.

Anti-Foam Agents

Many pesticides and spray adjuvants can produce large amounts of foam in tank mixes. Foam can cause the tank mix to overflow, causing possible contamination of soil and human exposure. Although foam is something that can be reduced it should be prevented.

Anti-Foaming agents are spray adjuvants that prevent foaming in emulsions, wettable powders and water based systems. Anti-Foaming agents help minimize entrapped air caused by mechanical agitation in spray tanks.



Anti-Foam agents are added to a tank before other solutions to prevent the formation of foam.

Penetrants

Many pesticides must be able to penetrate into a plant's cuticle in order to perform effectively. This is not easy for pesticides to do because most leaves have a hairy, waxy surface that acts as a barrier to the cuticle.

Penetrants are spray adjuvants that cause the wax particles on a leaf's surface to stand upright, which opens up passage to the leaf's cuticle. This encourages rapid penetration of the pesticide which allows it to act quicker. Penetrants, because they allow rapid penetration, also make pesticides less vulnerable to breakdown by ultraviolet light.



The Draves Wetting Test (left) predicts how thoroughly and rapidly an adjuvant will wet and penetrate plant tissue by measuring how thoroughly the solution wets cotton skeins.

Spreaders

In order for many pesticides to perform to their full capacity, they must thoroughly coat all parts of the target plants. An even coating is extremely important for contact pesticides. However, because most pesticides are applied using water as the carrier, surface tension causes spray solution droplets to slide off of plant surfaces, leaving areas uncovered.

Spreaders are spray adjuvants that reduce the surface tension of spray solution droplets to the point that they can spread and blend together to uniformly coat plant surfaces, avoiding costly runoff of spray material.

Spreaders allow for more uniform coverage of pesticides and reduce run off.



A sticker allows the spray solution to adhere to the leaf's surface and resist wash off.

Stickers

Once a pesticide has been applied to a plant's surface, it must stay there long enough to perform its function. Rainstorms, fog, irrigation water and other environmental circumstances can cause pesticides to wash off before they have had a chance to work to their full potential.

Stickers are spray adjuvants that help pesticide spray solution droplets cover and adhere firmly to plant surfaces and resist being washed off. Stickers are designed to keep the pesticides in place during their intended use period.

Protecting the crop, a farmer's most important investment, is our number one goal. That's why only the finest grade of active ingredient is used to produce post patent crop protection chemicals manufactured by Willowood USA.

For more information on individual spray adjuvants please call Willowood USA.



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