



**AGRO SOLUTIONS**  
Tank mix adjuvants

**We keep an eye on your growth**

## ABOUT US

**LEVACO Chemicals GmbH** is a leading manufacturer of dispersants, emulsifiers, wetting agents and anti-foaming agents.

**LEVACO's** products are used in agricultural formulations, fibre manufacturing as well as the development of paints and coatings. In addition, LEVACO also manufactures specialty chemicals for major chemical companies on a contractual basis.

**LEVACO's** headquarters and production site are in the Chempark in Leverkusen.  
**LEVACO** is an innovative company which is guided by experienced leadership.  
**LEVACO** is a member of the Diersch & Schröder Group from Bremen, Germany.

**LEVACO** manufactures a wide range of additives and adjuvants for agrochemical formulations. Our Agrochemical team is experienced and has an in-depth knowledge of the development, production, and use of these products.



## Tank mix adjuvants

Spraying pesticides onto crops can be inefficient when there are challenges with the chemical nature of the mixture, difficulty with the technical spray process or unfavorable climatic conditions. Fortunately, the performance of the tank mix can be optimized by adding adjuvants.

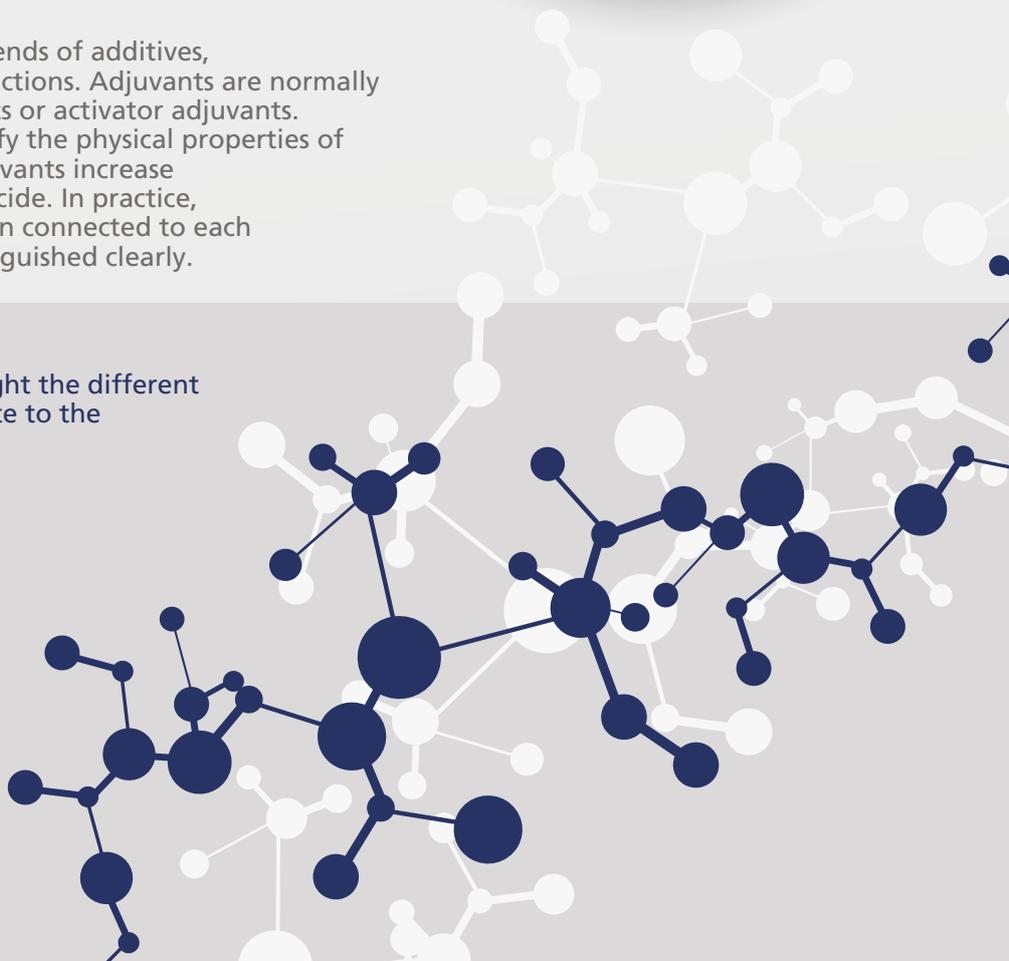
These tank mix adjuvants are able to ease the application and to increase the effectiveness of the spray process as well as the bioefficacy of the active ingredients. Therefore, from both an economic and environmental point of view, using such adjuvants is beneficial.



## What is an adjuvant and how does it work?

Tank mix adjuvants are usually blends of additives, which are selected for specific functions. Adjuvants are normally classified as either utility adjuvants or activator adjuvants. Utility adjuvants are able to modify the physical properties of the spray mix while activator adjuvants increase the biological activity of the pesticide. In practice, however, these functions are often connected to each other and cannot always be distinguished clearly.

The following sections will highlight the different ways in which adjuvants contribute to the performance of spray mixtures.



## UTILITY ADJUVANTS:



### Stabilization/Compatibility

Often different pesticides, formulation types (e.g. EC, SC or OD) or adjuvant oils are added in one and the same spray mix. Several of these combinations show a poor compatibility with their mix partners. This leads to a rapid phase separation, or a sedimentation, etc. When the spray mix is not homogeneous, it causes an uneven spray distribution on the crops, where some of the crop area receives too high or too low concentration levels of the active ingredient. The result is a poor disease control, a phytotoxic effect or even a build-up of resistance in the target organism. Corresponding tank mix adjuvants contain specialized surfactants, which prevent or slow down the effects of phase separation. Thus, a spray mix which usually separates within minutes forms a long-term stable uniform mixture when the right adjuvant is used.



### Drift control

When the operator is spraying the spray mix onto the crop during windy weather conditions a significant amount of the spray is blown away and misses its targeted leaves. This can reduce the success of the disease control and lead to a contamination of the environment. The spray drift is strongly dependent on the droplet size. Even when there is a low wind speed small and light droplets are able to easily be carried away, compared to heavier and larger droplets. When the spray nozzle is set to an increased droplet size, it may reduce the drift but it also generates too large droplets which easily run off the leaf. A specialized tank mix adjuvant is able to reduce the drift significantly by changing the physical properties of the spray liquid such that the droplet size distribution becomes narrow. In combination with a well-adjusted spray nozzle, most droplets will be just the right size and will neither run off the leaf nor be carried away by the wind.



### Retention

Once the sprayed droplets reached the leaf surface, it is important that they also remain there. Pesticides running off the leaf onto the ground cause an inefficient disease control as well as environmental issues. Therefore, special adjuvants which are called retardants are used to modify the droplets to be inelastic and sticky which makes them spread on the leaf but not bounce or flow off of the leaf.



### Rainfastness

In humid and rainy areas, the challenging issue is the loss of the active ingredients by rain which washes off the spray mix residue on the leaf. To reduce this loss, tank mixes with hydrophobic adjuvants are used. These adjuvants spread on the leaf and are able to repel the rain. They bind to the leaf surface, either physically, chemically or in the form of a film such that the active ingredient is protected from the rain. Thereby, such adjuvants extend the time for the active ingredients to penetrate into the leaf.



## ACTIVATOR ADJUVANTS:

Optimizing the bioavailability of active ingredients in order for them to unfold their full biological potential, is one of the strongest pursuits within agrochemistry. On the one hand, it saves the crop by securing the effectiveness of the plant protection agents. On the other hand, it reduces the amount of plant protection agents and helps to minimize the exposure of xenobiotics to the environment. Tank mix adjuvants that support the bioavailability in any way (e.g. wetting agents, penetration enhancers, etc.) are called activators.



### Wetting/Spreading

As soon as a spray droplet hits a leaf, it should adhere to its surface and spread immediately to achieve the optimum coverage of the active ingredient on the leaf. Measuring the surface tension of a liquid is a general way to determine the ability of the droplet spreading onto the leaf's surface. For pure water, the surface tension is about 72 mN/m and is reduced down to 20 mN/m with a potent wetting agent. Another important measure is the timescale in which the process takes place. The time a droplet covers the distance from the spray nozzle onto the leaf is usually about 20 milliseconds. Thus, a good wetting adjuvant not only reduces the surface tension and contact angle on a leaf but it also acts fast enough so that this process will take place while the droplet is still on the leaf.



### Humectant

In order to allow the active ingredient to penetrate into the tissue of the leaf, it is important to keep it in a mobile form. When the spray coverage dries on the leaf, the active ingredients become immobile due to agglomeration or precipitation as crystals. Thus, it is important to delay the drying-up of the spray coverage. Adjuvants that maintain a liquid spray coverage are called humectants. They can either be hygroscopic salts or polymers, polyols, etc.



### Penetration enhancer

The penetration of active ingredients through the outer layers of the target plant is another important and the rate-limiting step in the application of plant protection agents. Even if all other physicochemical factors are optimized, active ingredients that are absorbed too slow lead to an ineffective disease control. Furthermore, an insufficient uptake of plant protection agents increases the risk of building up resistances or contaminating the environment. Penetration enhancers enable or support the active ingredients to pass through the leaf's outer boundary layer into the plant.



## Ways in which LUCROP® tank mix adjuvants improve the spray application



## LUCROP® PRODUCTS

**LUCROP® BAN** is a tank mix adjuvant, designed to increase the stability of spray mixes that may contain oil as well as to improve the rainfastness. It is used in a tropical climate where spray residues are often washed off of the leaves or diluted by strong rainfall. **LUCROP® BAN** is a multifunctional adjuvant containing emulsifiers, wetting and retention agents, as well as a sticker in one product. Initially, it was designed to help control the fungal disease “Black Sigatoka” for banana crop protection. However, this adjuvant is also applicable to different pesticides and on other crops under similar climatic conditions.

**LUCROP® SOL** is developed to prepare a stable spray oil emulsion. It supports an improved spray mix with EC and OD formulations. Particularly when working with crop oils **LUCROP® SOL** provides a significantly increased stability of the spray mixture. Additionally **LUCROP® SOL** supports a good spreading on difficult to wet leaves. This tank-mix adjuvant is compatible with herbicides, insecticides and fungicides. It can be used with various different types of oils.

**LUCROP® ADA** is a special adjuvant designed to improve the drift control of pesticide sprays as well as the retention on the target leaves. By reducing the loss due to wind and run-off, the adjuvant minimizes the environmental impact of pesticides and increases the economic benefits. Additionally, it is based on renewable and biodegradable components.

**LUCROP® WRF ULTRA** is a complex blend of surfactants and additives, securing and improving the overall performance of pesticide sprays. The adjuvant contains stabilizers, humectants, wetting agents and penetration enhancers to optimize the bioefficacy of pesticides. It is compatible with a wide range of crop protection agents and applicable on most crops. Its composition is based on biodegradable ingredients which minimize the ecological impact.

**LUCROP® HPP** belongs to the family of **LUCROP® WRF ULTRA** with the same main function as an activator agent. It is adjusted to also suit the spray applications UAV (unmanned aerial vehicle).

**LUCROP® SWEP** combines a super spreading function with an excellent activation effect, resulting in a tank mix adjuvant which leads to a superior coverage of the target leaf surface and optimizes the bioefficacy of pesticides. The tank mix proves its skills particularly well on crops with strong hydrophobic leaf surfaces. It is able to be used with herbicides, fungicides, and insecticides.

**LUCROP® SWEP-L** is particularly suitable for plant surfaces with medium to low hydrophobicity. This cost efficient tank-mix additive shows a comparable dynamic surface tension profile to **LUCROP® SWEP**, is blended with penetration enhancers.

**LUCROP® SW** is a siloxane spreader with the superb wetting properties known for this class of surfactant chemistry. It is suitable for wetting even the most hydrophobic plant surfaces. An even coverage on the leaves is ensured and results in an enhanced uptake of the active into the plant.

**LUCROP® SURF 1** is a potent wetting agent which ensures an even spreading on the targeted leaf. It also increases the rainfastness of the spray and enhances the uptake of active ingredients, especially herbicides and insecticides.

**LUCROP® ROIL** contains oils and surfactants which are selected specifically to act as penetration enhancers. Due to its property as humectant and film forming agent the bioavailability of the pesticides is increased. Wetting agents in **LUCROP® ROIL** reduce the dynamic surface tension and improve retention, spreading and coverage of pesticides on hydrophobic leaf surfaces.

PRODUCT OVERVIEW

	Utility adjuvants				Activator adjuvants		
	Spray mixture				Biological availability		
							
	Stabilization	Drift control	Retention & Sticking	Rainfastness	Wetting & Spreading	Humectant	Penetration
LUCROP® BAN	● ● ◐	●	● ●	● ●	●	●	● ●
LUCROP® SOL	● ● ●			●	●	●	●
LUCROP® ADA	● ●	● ●	● ● ●	● ●		●	
LUCROP® WRF ULTRA	● ●		●		● ◐	● ●	● ●
LUCROP® HPP	●				●	● ◐	● ●
LUCROP® SWEP	●		●		● ● ●	●	● ◐
LUCROP® SWEP-L	●		●		● ● ● ◐	●	● ◐
LUCROP® SW			◐		● ● ● ●		●
LUCROP® SURF 1			●	●	● ●		●
LUCROP® ROIL	●		● ●	●	●	● ●	● ● ●



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