



AGRO SOLUTIONS

We keep an eye on your growth

TANK MIX ADJUVANTS

CONTENT

| | | |
|---|---------------------|--------|
| ■ | About us | Page 2 |
| ■ | Tank Mix Adjuvants | Page 3 |
| ■ | Application | Page 4 |
| ■ | Utility Adjuvants | Page 5 |
| ■ | Activator Adjuvants | Page 7 |
| ■ | Product Overview | Page 8 |
| ■ | LUCROP® Products | Page 9 |



ABOUT US

At **LEVACO** Agro-Solutions - the agrochemicals department of **LEVACO** - our team works daily to develop innovative solutions for farmers facing various challenges in pest control.

These challenges include the chemical nature of different crop protection products and formulations, leading to instabilities in the spray mixture. The spray process itself can cause issues such as spray drift or nozzle blocking. In addition, extreme weather conditions result in less satisfying and efficient treatments with crop protection products.

The introduction of new technologies in farming, like drone application, also poses challenges to the performance of the pesticide formulations.

At **LEVACO** Agro-Solutions, we understand these problems and needs. We optimize the performance of the tank mixtures by providing matching adjuvants.

Our tank mix adjuvants make the application easier, increase the effectiveness of the spray process and the bio efficacy of the crop protection products.

Once, we started with a distinct problem-solver in banana growing, where pest control is crucial for fighting a threatening fungus.

Now, we continuously develop new and specialized tank mix additives under the name **LUCROP**[®], aiming to improve spray mixtures for farmers cultivating various types of crops worldwide.



TANK MIX ADJUVANTS

Tank mix adjuvants are additives intended to be given directly into the spray mixture to improve the utilization or the biological efficacy of crop protection product(s) and fertilizer treatment.

Spraying crop protection products onto crops can be inefficient when there are challenges with the chemical nature of the mixture, difficulties 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 ease the application and increase the effectiveness of the spray process by enhancing the bio efficacy of the crop protection products. Therefore, from both an economic and environmental perspective, using such adjuvants is beneficial.



APPLICATION

WAYS IN WHICH TANK MIX ADJUVANTS IMPROVE THE SPRAY APPLICATION:

**pH BUFFER,
WATER HARDNESS REGULATOR**
Adjusts unfavorable water conditions



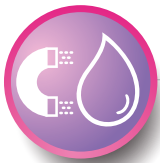
FOAM CONTROL
Reduces foam formation



STABILIZATION/COMPATIBILITY
Ensures homogeneous spray application



RETENTION
Improves adherence



RAINFASTNESS
Reduces wash-off



DRIFT CONTROL
Prevents spray loss by wind



WETTING/SPREADING
Optimizes leaf coverage



HUMECTANT
Maintains pesticide bioavailability



PENETRATION ENHANCER
Accelerates pesticide uptake



UTILITY ADJUVANTS

Utility adjuvants modify the physical properties of spray mixtures which may enhance the stabilization, reduce wind drift, improve retention, or ensures rainfastness. These additives play a crucial role in optimizing the overall performance of crop protection product applications, contributing to increased efficacy, and reduced environmental impact.



pH BUFFER, WATER HARDNESS REGULATOR

Water hardness and pH-value have a strong impact on the stability of the spray mixture. Farmers observe that the spray mixture can change in its effectiveness when different water sources are used. To avoid the negative effects of an adverse pH-value and high water hardness, specialized tank mix adjuvants containing buffer systems are used to adjust the pH-value and reduce water hardness.



STABILIZATION/COMPATIBILITY

Often, different crop protection products, formulation types (e.g. EC, SC or OD), or adjuvant oils are combined in a single spray mixture. Many of these combinations show a poor compatibility with their mix partners, resulting in rapid phase separation or sedimentation. When the spray mixture is not homogeneous, it leads to an uneven distribution on the crops, causing some areas to receive either excessively high or low concentrations of the crop protection product. This can result in ineffective disease control, phytotoxic effects, or even the development of resistance in the target organism. Specialized tank mix adjuvants, containing specific surfactants, are designed to prevent or slow down the effects of phase separation. Consequently, a spray mixture that would usually separate within minutes forms a long-term stable and uniform mixture when the right adjuvant is used.



FOAM CONTROL

The dilution of active ingredient concentrates in water sometimes leads to the formation of foam which may become an issue. While foam does not impact the quality of the spray mixture, it does cause a complication by foaming out of the spray tank and possibly endangering the operator. In this case, defoamers can be added to the tank mixture to reduce or prevent any foam formation.





DRIFT CONTROL

When the operator is spraying the spray mixture onto the crops in windy weather conditions, a significant amount of the spray can be carried away, missing its targeted leaves. This not only reduces the efficacy of disease control but also causes a risk of environmental contamination. The extent of spray drift is strongly dependent on droplet size. Even at low wind speeds, small and light droplets are easily carried away, unlike heavier and larger droplets. When the spray nozzle is set to an increased droplet size, it can reduce drift, but it may also generate too large droplets that can easily run off the leaf. A specialized tank mix adjuvant effectively minimizes drift by modifying the physical properties of the spray liquid, creating a narrow droplet size distribution. Combined with a well-adjusted spray nozzle, this ensures that most droplets are of optimal size, preventing run off and minimizing the risk of being carried away by the wind.



RETENTION

After the sprayed droplets reach the leaf surface, it is crucial that they adhere to it. Crop protection products running off the leaf and onto the ground result in less efficient disease control and environmental issues. Therefore, special adjuvants are used to modify the droplets, making them inelastic and sticky. This ensures that the droplets spread on the leaf without bouncing or flowing off.



RAINFASTNESS

In humid and rainy areas, a challenge is the loss of crop protection products washed-off by rain. To reduce this loss, tank mixes with hydrophobic or film-forming adjuvants are used. These adjuvants spread on the leaf and can repel the rain. They adhere to the leaf surface, either physically or chemically, protecting the crop protection product from rain. Thus, these adjuvants extend the time for the crop protection products to penetrate into the leaf.



ACTIVATOR ADJUVANTS

Activator adjuvants optimize the bioavailability and efficacy of crop protection products. They play a crucial role in enhancing the performance of the tank mix by improving absorption, penetration, and effectiveness.



WETTING/SPREADING

As soon as a spray droplet makes contact with a leaf, it should adhere to the surface and spread rapidly to achieve optimal coverage with the crop protection product. Measuring the surface tension of a liquid is a common method to determine the ability of the droplet to spread onto the leaf's surface. For pure water, the surface tension is about 72 mN/m, which can be reduced to 20 mN/m with a potent wetting agent. Another crucial factor is the timescale in which the process takes place. The time a droplet covers the distance from the spray nozzle onto the leaf is typically around 20 milliseconds. Therefore, an effective wetting adjuvant not only decreases the surface tension and contact angle on a leaf but also acts quickly enough to ensure that this process occurs while the droplet is still on the leaf.



HUMECTANT

To facilitate the penetration of the crop protection product into the leaf tissue, it is crucial to keep it in a mobile form. Once the spray coverage dries on the leaf, the crop protection product becomes immobile due to agglomeration or precipitation as crystals. Therefore, delaying the drying-up of the spray coverage is essential. Adjuvants that maintain a liquid spray coverage are called humectants. They can be hygroscopic salts, polymers, polyols, etc.










PENETRATION ENHANCER

The penetration of crop protection products through the outer layers of the target plant is another crucial and the rate-limiting step in the application of plant protection agents. Even if all other physicochemical factors are optimized, crop protection products that are absorbed too slowly lead to 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 crop protection products in passing through the leaf's outer boundary layer into the plant.



PRODUCT OVERVIEW

Evaluation of LUCROP® products with utility & activator properties:

| LUCROP® tank mix adjuvants | UTILITY ADJUVANTS | | | | ACTIVATOR ADJUVANTS | | |
|--------------------------------------|---|---|--|---|---|---|---|
| | Spray mixture | | | | Biological availability | | |
| |  Stabilization |  Drift control |  Retention & Sticking |  Rainfastness |  Wetting & Spreading |  Humectant |  Penetration |
| LUCROP® BAN | ●●●○ | ● | ●● | ●● | ● | ● | ●● |
| LUCROP® SRF | | | ●●● | ●●● | | ● | |
| LUCROP® ADA | ●● | ●● | ●●● | ●● | | ● | |
| LUCROP® ROIL | ● | | ●● | ● | ● | ●● | ●●● |
| LUCROP® SURF 1 | | | ● | ● | ●● | | ● |
| LUCROP® SW | | | ● | | ●●●● | | ● |
| LUCROP® SPREAD 24 | | | ● | ● | ●●●● | | ● |
| LUCROP® SPREAD 34 | | | ● | ● | ● | | ● |



LUCROP® PRODUCTS

LUCROP® BAN is a tank mix adjuvant, designed to increase the stability of spray mixtures that may contain oil as well as to improve the rainfastness. It is used in tropical climate where spray residues are often washed off from the leaves or diluted by strong rainfall. **LUCROP® BAN** is a multifunctional adjuvant containing emulsifiers, wetting and retention agents, as well as 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 with different crop protection products and on other crops under similar climatic conditions.

LUCROP® SRF is a sustainable and environmentally friendly blend of bio-derived polymers free of microplastics. Its film-forming properties creates a protective layer, enhancing the rainfastness and improving the adhesion of crop protection products to plant surfaces.

LUCROP® ADA is a special adjuvant designed to improve the drift control of crop protection 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 crop protection products and increases the economic benefits. Additionally, it is based on renewable and biodegradable components.

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 crop protection products is increased. Wetting agents in **LUCROP® ROIL** reduce the surface tension and improve retention, spreading and coverage of crop protection products on hydrophobic leaf surfaces.



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

LUCROP® SW has super-spreading and penetrating properties. It adjusts the physico-chemical properties of the spray mixtures to increase the wetting and the retention of sprays on foliar surfaces and boosts penetration of crop protection products. It can also be used as in-can additive for aqueous or non-aqueous based formulation types.

LUCROP® SPREAD 24 shows super-spreading and penetrating properties and additionally a reduced foam formation. **LUCROP® SPREAD 24** adjusts physico-chemical properties of the spray mixtures to increase the wetting and the retention of sprays on foliar surfaces and boosts penetration of crop protection products. It can also be used as in-can additive for non-aqueous formulations.

LUCROP® SPREAD 34 is a tank mix spreader designed for agrochemical foliar application. It improves the spreading even on hydrophobic surfaces. When sprayed on leaves, it increases the wetting and the retention of sprays on foliar surfaces and by such the bio efficacy of the crop protection product.

LUCROP® SWET is a high-performing soil amendment that significantly boosts water retention in dry soil, remains effective through multiple wash-out cycles, and works well in low concentrations across various soil types. **LUCROP® SWET** is eco-friendly with a silicone and NP (nonylphenol) free composition.



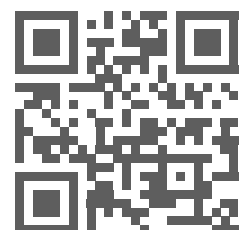


LEVACO Chemicals GmbH

Johannes-Kepler-Str. 20
51377 Leverkusen
Germany

+49 214 86927-0

agro@levaco.com
<https://lucrop.levaco.com>



Member of Diersch & Schröder Group